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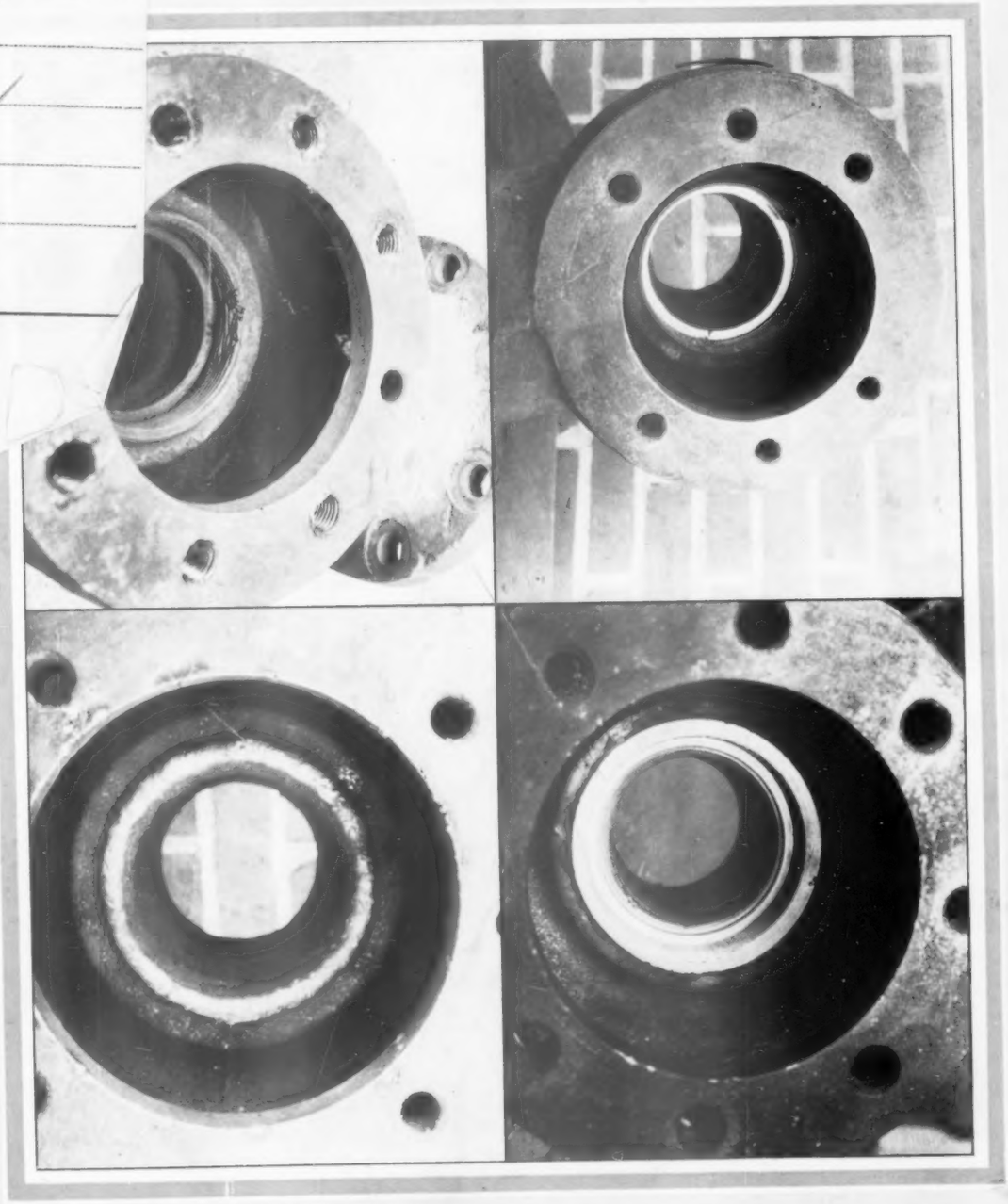

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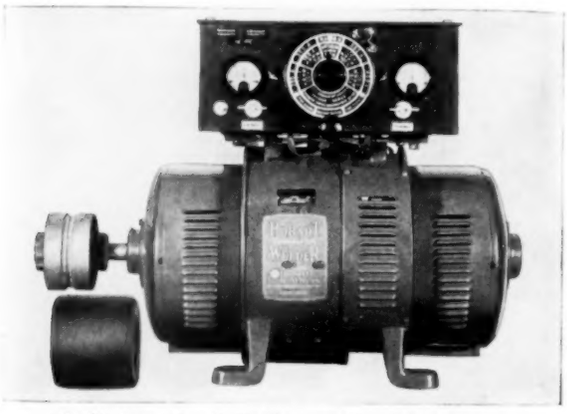

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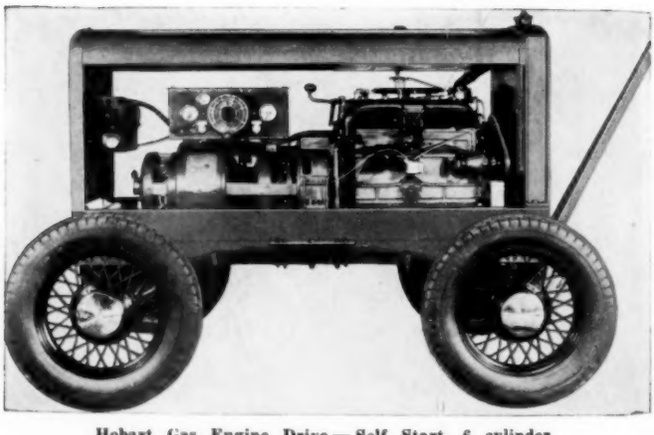

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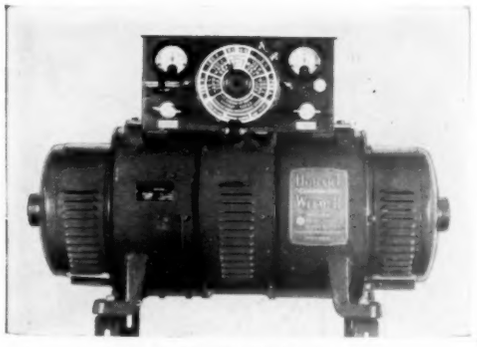

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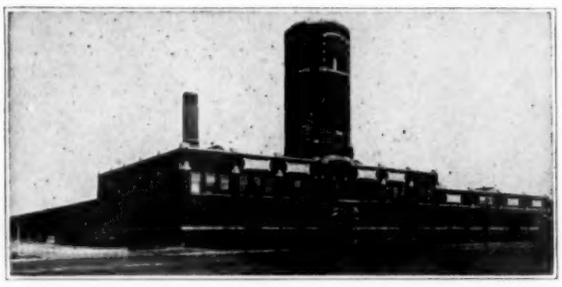

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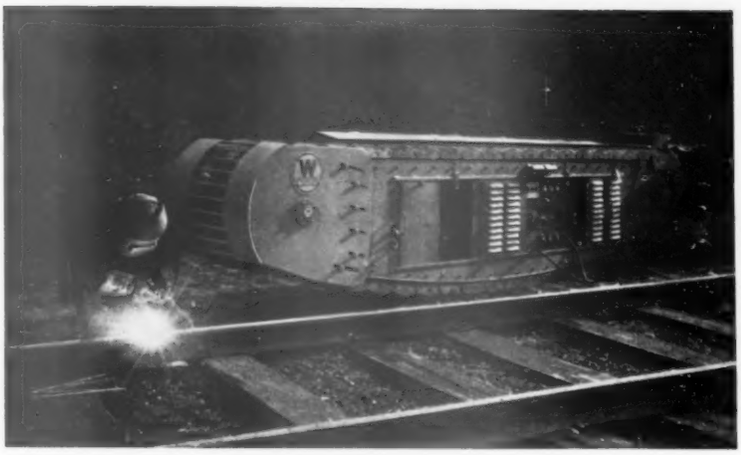
The new Westinghouse FlexArc Tractor Welder for railroad track maintenance.



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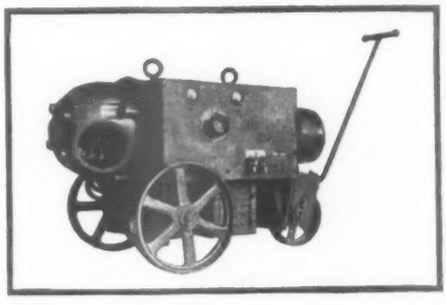

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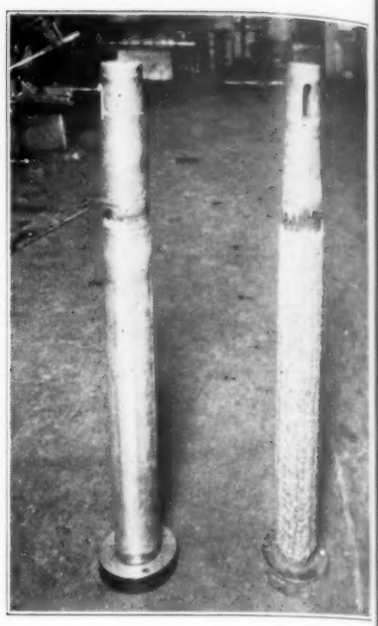


Roller Shaft for Pulverizing Mill Built Up by Welding and Machined to Size.

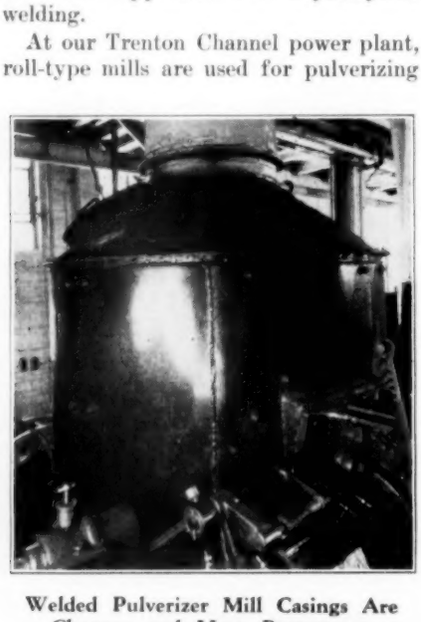
How a large power company uses welding in the

Maintenance of Valves and Mechanical Parts

■ By RALPH BRISCOE
Plant Engineer, Detroit Edison Company

THE power plants offer a large field for the use of welding, particularly for the rehabilitation of worn and damaged parts. A few outstanding examples are cited. While electric-arc welding was used in most cases, there were also some applications of oxyacetylene welding.

At our Trenton Channel power plant, roll-type mills are used for pulverizing



Welded Pulverizer Mill Casings Are Cheaper and More Permanent.

coal, and until recently we had not been entirely successful in keeping the coal dust out of the bearings. There are 26 of these mills, with 6 roll shafts in each, making a total of 156 shafts, all of the same design and about the same dimensions. Once every two years it has been necessary to replace these shafts, as they have in that time become so worn as to have too much lost motion. These shafts cost about $60 each and to replace them would require about $4,500 a year. It was found that the old shaft could be machined, resurfaced with welding material, and remachined for a cost of about $20, which represents a saving of some $3,000 a year.

For the mill casings, sheets are shaped and, instead of being bolted, are welded on the outside of the casing, as illustrated. In addition to reducing the cost of fabrication, this eliminates nut and bolt ends sticking through the inside of the casing, which would eventually erode off, causing a loosening of the casing and leakage around the bolt.

The above problems might be considered as ordinary, but there are some jobs to which welding is applied that may be considered extraordinary. Very frequently, and for various reasons, leakage occurs between the seat and body of valves used in high-pressure-steam and hot-water service, which causes a great deal of inconvenience. The first cost of the valve is generally so high that replacement is frowned on; therefore, some method had to be conceived to rehabilitate the equipment rather than tolerate the leakage.

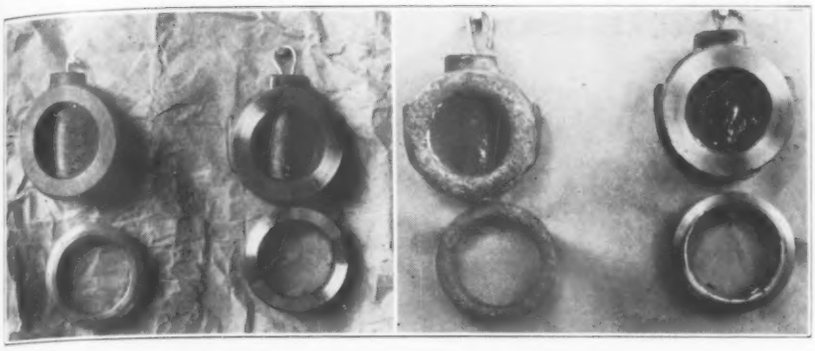
Steam at high pressures and high temperatures imposes a severe service on many parts of power-plant equipment, causing wear and leakage which the welder is called on to rectify. Some of the parts thus rehabilitated are better than the original part, as pointed out in this paper given before the Highway Congress in Detroit, Mich., January 18, 1933.

Reconditioning Valves by Welding

As an illustration, consider the cast-steel body of a 4-in. safety valve for 400-lb. pressure. The views on the front cover of this issue show how the steam has eroded away the threads into which the seat was screwed, the same body after machining out the threads, then its appearance after resurfacing by welding, and after remachining and threading for the seat. This work is done at a cost of about $20 as compared with $400, the original cost of the valve. After this process, there is seldom a recurrence of the trouble.

The need for reconditioning is partly due to the fact that in most cases a non-ferrous metal, such as monel, is used for the seat material, and when new and subjected to high-pressure, high-temperature steam, there is growth of the seat material and, due to the difference in thermal properties, a loosening up of the seat. When the same seat is put back in after welding and machining, apparently there is no continuation of growth.

On the other hand, valves have persisted in giving us trouble in this connection. Such was the case with some of the 6-in. automatic-closing throttle valves. These were equipped with synthetic monel seats, but all efforts failed to prevent leakage between the body and seat. Finally, seats were made of forged stainless steel and, with the use of a special



Gates and Rings for 2½-In. Gate Valve Shown Before Machining, After Machining, Then With Stellite Applied and With Stellited Faces Machined.

welding rod, the seats were welded into the body; this eliminated the trouble.

Primarily, the economy is between the cost of a new seat plus welding, and a new valve, which is in the order of $60 as compared with $750 to $1,000. This does not, however, bring into the picture the troubles caused by leakage through the valve seat.

If the turbine is standing still, leakage of steam into the machine causes serious corrosion and overheating of the condenser, which results in drying of the packing and a lot of other troubles. These were all eliminated by welding the seat into the body.

Large high-pressure steam valves up to 14 in. in size have been rehabilitated in a similar manner to the safety valves, their original cost being about $1,500 each. The cost to rehabilitate them is between $30 and $40.

Frequently, difficulty is experienced by the cutting of the faces of seats and discs of valves, representing a serious inconvenience. A technique was recently developed for the application of a hard-surfacing material, by welding, to the seat and disc faces, which has apparently completely overcome the difficulties. Valves have been in service for two years after being so rebuilt without experiencing difficulties or operating troubles by steam cutting. The application of hard-surfacing material has also been extended to other uses.

Repairing a Screw Conveyor

The apparatus used for transporting pulverized coal from the coal-preparation house to the boiler room consists of a shaft on which a steel helix is welded, the outside diameter of the helix being 20 in. With this piece of apparatus, up to 75 tons of pulverized coal per hour can be elevated a distance of 90 ft. into the boiler room. This screw travels at a speed of approximately 1,140 r.p.m., and there is considerable wear on the face of the flight and along the discharge end of the shaft. The edge of the flight, as well as the shaft, has been resurfaced with a hard-facing material, which has considerably reduced wear and necessity of replacement of the screw.

We might continue with such items as impellers on water runners for high-pressure seals of large turbines. These water runners are worth about $1,000. They have a narrow section which makes a gasket face against the shoulder of the main shaft. Leakage will develop between the gasket faces, resulting in cutting the water runner. These are machined, welded, and remachined at a cost of between $15 and $20.

Salvaging Defective Valve Bodies

Frequently cast-steel valves develop leaks because of sand holes in the body of the castings. Welding makes the repair of these castings possible and saves the company a great deal of money. Recently a partial list of such repairs at one of our power plants showed the replacement value of such valves to be $3,700, whereas the repairs by welding did not exceed $500. The method used is not new but follows the standard practice of chipping out the defective places and depositing layers of weld metal, then peening each layer to relieve stresses. We are now using coated electrodes for this work.

Welding at World's Fair Is Topic at Meeting

At a special meeting of the Chicago Section of the American Welding Society, held in the Joseph Urban Room in the Congress Hotel on June 29th, at 10:30 A. M., several papers were read giving details of some of the welded construction in evidence at the Chicago World's Fair. This meeting was held during Engineering Week to give visiting engineers an opportunity to become informed on the welding and cutting processes.

A general paper on the application of welding and allied processes and dealing mostly with the application of welding in the buildings at the Fair was read by J. M. Jardine of the Western Welding & Boiler Repairing Co., Chicago. This was followed by an illustrated talk on the "Design and Construction of the Sky Ride Towers" given by A. L. Wilson of the Mississippi Valley Structural Steel Co. The application of welding and cutting in the fabrication of the Nash-Whiting parking tower at the world's fair was described by W. B. Keelor, of the Whiting Corp. The papers were followed by a general discussion.

A distinguished guest at the dinner which followed the meeting was Dr. Jean Piccard, who is to participate in the balloon ascension into the stratosphere, which will start from the World's Fair grounds.

Urges State to Supervise Pressure-Vessel Work

A code of practices and state supervision of construction of unfired pressure vessels are probable for the near future in California, according to information following an investigation into the cause of a recent explosion at the Richfield Oil Co.'s gasoline plant in the Signal Hill oil field, which resulted in ten deaths and many injured.

An extract from the findings of the coroner's jury composed of men familiar with welding and the construction of natural-gasoline plants, is quoted as follows: "In view of the testimony submitted to the jury and the widespread effect of this catastrophe involving great loss of life and property, the jury recommends that the State Industrial Accident Commission undertake without delay the supervision of construction and operation of unfired pressure vessels, particularly in oil and other industries handling or treating inflammable materials." The testimony brought out clearly established the fact that no such supervision has been exercised by any official department of the state or government.

An examination of the ruins left by this explosion and fire, which occurred June 2nd, revealed that practically all welds were intact, while the welded plate and pipe were torn or fractured either across the welds or quite a distance from the welds.

Quite a rush of work in welding and oxyacetylene cutting for local welding shops resulted from this catastrophe. A great deal of damage was done to nearby plants, derricks, pumping equipment, etc. Torch cutting proved a very effective aid in clearing away the tangled mass of steel derricks, pipe, sheet metal, etc.

The primary cause of the explosion is believed to have been the overfilling of a horizontal storage tank of casinghead gasoline which, becoming ignited, caused the major explosion.

The Fundamental Characteristics and Technique of

Spot Welding Various Metals—I

(First in a Series of Two Articles)

■ By LAWRENCE FERGUSON
Member of Technical Staff,
Bell Telephone Laboratories, Inc.

IN RECENT years, spot welding has become a common step in the manufacture of innumerable products. Although the best welding conditions for each commercial job differ greatly and must be found chiefly by trial, there is a continual demand for information concerning the weldability and technique of spot welding of various combinations of metals. Considering the great commercial importance of the spot welding process, it is surprising that only a few papers have been published making any worthy contribution to the knowledge of the subject. Among these few are: (1) R. T. Gillette's[1] paper which presents a chart of metal combinations that can be spot welded, recommends electrode materials for welding them, and indicates the size of electrode tips for welding sheets of dissimilar thickness; and (2) C. L. Pfeiffer's paper[2] which, among other things, discusses various kinds of spot welds, the factors to be considered in making them, and methods of securing a proper balance of heat between the pieces being welded.

Since some of the material and recommendations appearing in the literature are inadequate and, in certain instances, faulty, it seems desirable to discuss considerable old material along with the new information presented in this paper.

[1] "Spot Welding of Dissimilar Metals," General Electric Review, Vol. 30, no. 9, p. 443 (1927).

[2] "Some Resistance Welding Problems," Jl. Amer. Welding Soc., Vol. 10, no. 4, p. 5 (1931).

IN THIS paper there are described the spot-welding process, the apparatus and method used, the technique of spot welding (including a discussion of some of the practical problems involved and their solution), and the welding characteristics of metals.

The Spot-Welding Process

In the process of spot welding, the metal pieces to be joined are placed in contact under pressure and an electric current is made to flow through the point of contact. The metal pieces are heated to about their melting point by the passage of electric current and are forced together by the applied pressure. The heating is concentrated in a small region, Figure 1(A), where the metal pieces are in contact with each other. The rest of the material between the electrodes remains comparatively cool because of the conduction of heat through the electrodes. Figure 1(A) shows, schematically, the flow of electric current and the area of metal heated most in two strips about to be welded. Figure 1(B) shows the strips after welding. Figure 2 is a photograph of welded strips of metal (brass and Allegheny metal).

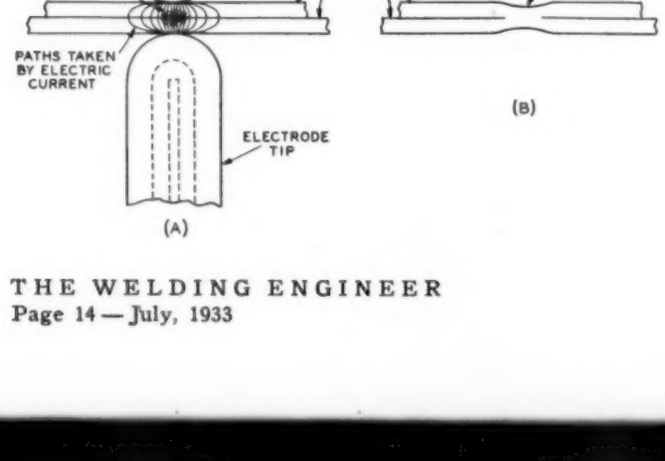


Fig. 1. Schematic Cross-Section of Spot Weld.

The temperature obtained in spot welding two pieces of metal depends upon many factors. Those pertaining to the pieces to be welded are: (1) electrical and thermal conductivities, (2) specific heat and heat of fusion, (3) size and shape (as they affect electrical resistance, rate of cooling by conduction, and current density), and (4) contact resistance (between the metal pieces themselves and between the pieces and the electrode tips).

Those factors pertaining to the electrode tips are: (1) electrical and thermal conductivities, (2) specific heat, (3) size and shape (as they affect current density and rate of cooling by conduction), and (4) type of electrodes (whether solid or water cooled).

Variables in the spot welding machine are: (1) welding voltage at the electrode

Table I. Actual Heating Voltages Across Electrode Tips on Open Circuit.

	Machine Setting	
Voltage	Primary Voltage	Transformer Tap Setting
0.75	55	1
0.85	55	2
0.88	55	3
0.95	55	4
0.97	55	5
1.00	55	6
1.05	55	7
1.05	55	8
1.10	55	9
1.14	55	10
1.22	55	11
1.28	55	12
1.34	55	13
1.45	55	14
1.50	110	1
1.63	55	15
1.70	110	2
1.75	110	3
1.78	55	16
1.89	110	4
1.93	110	5
2.00	110	6
2.10	110	7
2.10	110	8
2.20	110	9
2.28	110	10
2.43	110	11
2.55	110	12
2.68	110	13
2.90	110	14
3.02	220	1
3.26	110	15
3.40	220	2
3.50	220	3
3.55	110	16
3.78	220	4
3.86	220	5
4.00	220	6
4.20	220	7
4.20	220	8
4.40	220	9
4.56	220	10
4.86	220	11
5.10	220	12
5.35	220	13
5.80	220	14
6.52	220	15
7.10	220	16

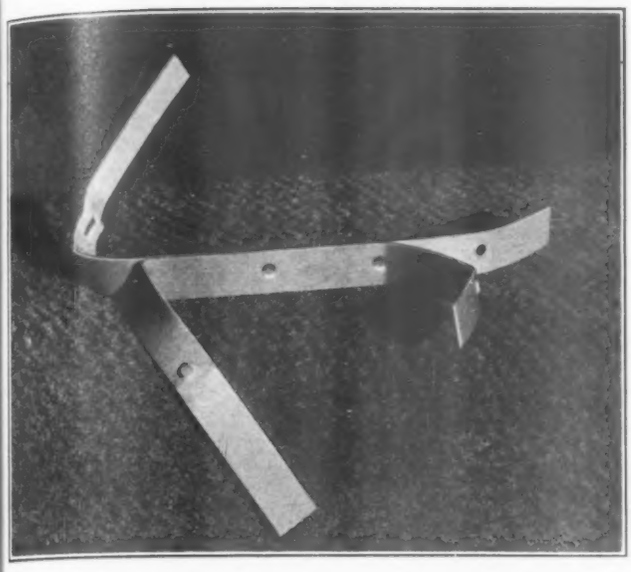


Fig. 2. Welded Strips of Brass and Allegheny Metal.

tips, (2) internal electrical resistance, (3) duration of current flow, and (4) pressure exerted by the electrodes during the welding process.

The nature and the strength of the weld obtained not only depend upon how well these factors are adjusted to each other, but also upon (1) the inherent strength of the welded materials after the heat treatment caused by the welding process, (2) the cleanness of the pieces welded, (3) the degree of wetting or alloying of the materials welded, (4) the strength of the alloy formed in welding, (5) the amount the welded material is squeezed[3] by the process, (6) the size of the weld, and (7) the medium in which the weld is made (that is, air, water, oil, etc.).

There are many other forms of welds (Figure 3) made with spot welding or similar machines, but these are all classified by Pfeiffer as spot, butt, or hybrid welds. Although, in making these different welds, the machine, electrodes, and manipulation may change, the process remains theoretically the same. Some description of the methods, machines, and technique is given in the papers by Pfeiffer[2] and Gillette[1], and in numerous bulletins of the companies manufacturing electric-resistance-welding machines and accessories.

Because of its versatility in handling various practical welding jobs as well as experimental work, an automatic No. 2 Gibb electric spot welding machine of 60-kva. capacity was used in obtaining the results given in this paper.

This machine has transformer tap settings which give a choice of fifteen different heating potentials. In addition, the machine was altered so that its transformer could be operated on either 55, 110, or 220 volts, thus giving a total range of 45 different heats. Table I shows the actual heating voltages as measured across the electrode tips on open circuit.

There is also a gear box which controls the speed of the machine, and a timing cam which, in conjunction with the speed of the machine, controls the duration of electric current flow. The speed can be changed from 45, 60, 75, to 100 spots per minute and the duration of current flow from about 0.05 to 0.20 seconds.

The pressure exerted by the electrodes can be varied from about 100 to over 450 lb. by changing the tension of a spring. The electrodes are 1 in. in diameter, are water cooled, and can be fitted with different kinds of tips.

The metal strips used for experimental work generally were about 0.25 in. wide and 0.025 in. thick, and the spot-welding machine was specially adjusted for them. The time of current flow was made approximately 0.17 seconds with the machine running at the rate of 45 welds a minute. The electrode pressure varied from 100 to 110 lb. Either elkaloy[4] or elkonite[4] dome-shaped tips were used on the electrodes, depending upon what metals were being welded. The electrodes were set a distance apart such that the maximum possible squeeze[3] was less than the thickness of one strip.

Apparatus and Method

Although, fundamentally, spot welding is a very simple process, the many factors affecting its success have tended to develop a somewhat complicated technique.

For example, the squeezing pressure of the electrodes must be adjusted to the strength and thickness of the material being welded. Obviously, greater pressure is required to force heavy steel bars together than thin sheets of tin. In the same way, more pressure can be used in welding a metal like iron, which has a long softening range, than in welding zinc or aluminum, which suddenly may melt and collapse altogether.

This shows that sometimes it is necessary to control carefully the maximum possible squeeze the electrodes can give, in order to avoid punching a hole in the metals or causing the weld to flash.[5]

The material, size, and shape of electrode tips are important variables which affect the results of the spot-welding process by their control of electric-current density in the pieces being welded and by their control of rate of cooling by conduction. Material for electrode tips should be chosen which best prevents them from alloying with the parts being welded, and which permits these parts to be heated most at their point of contact with each other. For almost all ordinary work on high-resistance metals, dome-shaped tips made of elkaloy or copper

[3]The amount of squeeze is the reduction in thickness of the welded materials at the weld. See Figure 1(B).

[4]Copper-tungsten alloys. Elkaloy is rich in copper; elkonite is rich in tungsten.

[5]Flashing is the name given to the phenomenon occurring when the spot-welded metal melts and produces an arc. This not only ruins the pieces being welded, but also spoils the electrode tips.

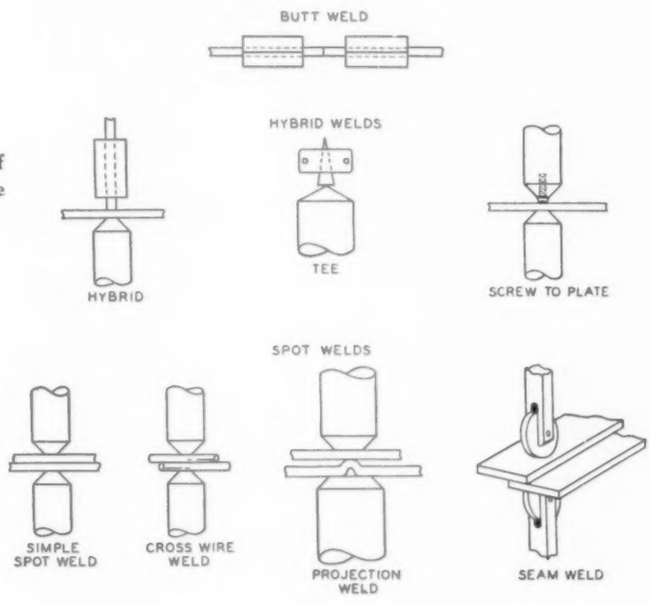


Fig. 3. Forms of Electric Resistance Welds.

are very serviceable. Thus, for welding strips of two metals, such as nichrome and steel, with melting points below 1600° C., electrode tips made of copper or elkaloy are best. These tips remain comparatively cool and so do not usually heat up enough to alloy with the strips.

Welding metals of high thermal and electrical conductivity, such as aluminum or copper, is much more of a problem, however. Here, so much more heating current must be used that the electrode tips themselves become hot. The metal strips may weld to each other no better than they do to the electrode tips, Figure 4(B, B). In this situation, a high-melting-point material such as tungsten[6], which does not alloy readily at ordinary welding temperatures, is needed as a tip material.

It is difficult, however, even with tungsten electrode tips, to spot weld these high-conductivity metals, because they heat all the way through, Figure 4(C), and still melt as quickly at the electrode tips as at the welding spot desired. This can be prevented only by making the contact between the strips and the electrodes large while keeping the contact between the strips themselves small, as in projection welding, Figure 4(D), or butt welding, Figure 3. The success of this scheme depends upon the sharp increase in current density, at the desired welding spot, caused by the reduced area of contact.

The different areas which are heated most with various combinations of metals and tips are shown diagrammatically in Figure 4.

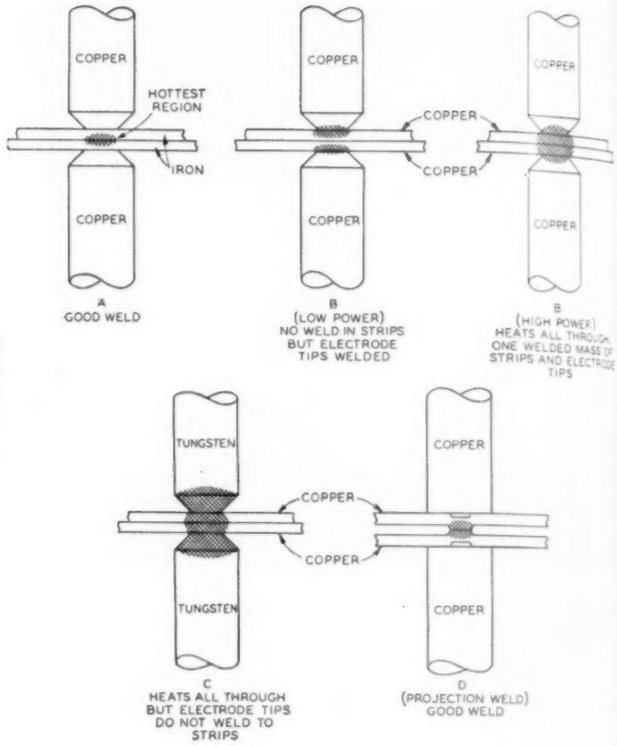


Fig. 4. Regions Heated Most When Spot Welding With Different Combinations of Metal Strips and Electrode Tips.

Welding a strip of high-conductivity metal to one of low conductivity presents still other difficulties. It does not matter, for instance, whether elkaloy or tungsten tips are used for welding copper to nichrome. With either tip material, the nichrome strip will overheat and melt before the copper is raised to a welding temperature. If too much of the nichrome melts, flashing[5] will occur.

As suggested by Gillette,[1] this trouble can be reduced or avoided by using dissimilar electrode tips to balance the unequal heating in the metals being welded. Thus, as shown in Figure 5, a tungsten tip should be in contact with the copper and an elkaloy or copper tip in contact with the nichrome. By this method, the copper strip is heated proportionately more and the nichrome less.

The unequal heating of copper and nichrome (and similar high- and low-conductivity combinations of metals) can be partially balanced also by appropriately regulating the current density in the two strips. This is accomplished either by projection welding or by using a small electrode tip against the copper and a large one against the nichrome. These methods are illustrated in Figure 5 and explained more elaborately later in a paragraph on welding unequal thicknesses of metals.

Dissimilar electrode tips may also be used advantageously at times when the strips being welded have widely different melting points or specific heats. Sometimes the heating can be balanced adequately by using strips of different thicknesses. Thus, as shown in Figure 5(F), thin copper (using a tungsten electrode tip) can be welded to thick nichrome more easily than strips of equal thickness can be welded together.

[6]Sold in the form of electrode tips, under the name "Elkonite No. 3."

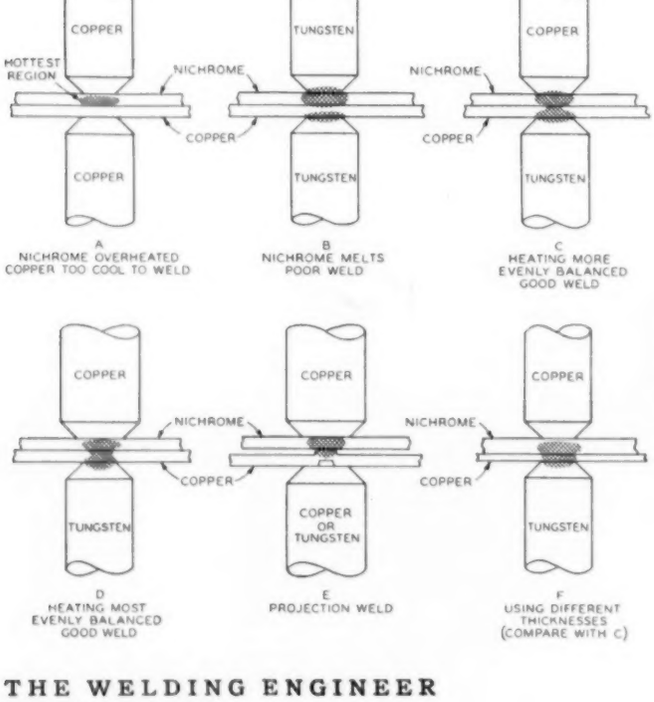


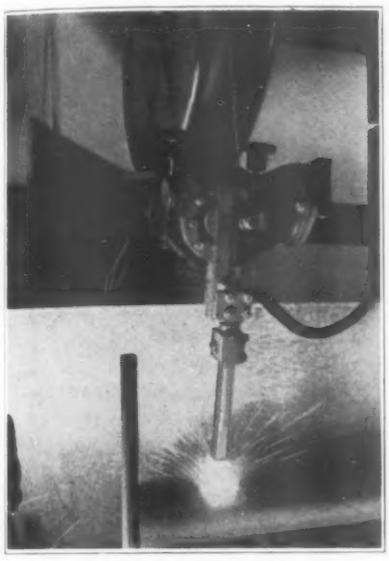
Fig. 5. Regions Heated Most When Welding Strips of Dissimilar Metals With Copper and Tungsten Electrode Tips.

Heating and Piping Group to Meet in Chicago

The annual convention of the Heating and Piping Contractors National Association will be held in Chicago, July 26th to 28th, with headquarters at the Hotel Sherman. A considerable part of the program will deal with the effect of the Industrial Recovery Act on business, including consideration of a proposed fair trade practice code. Committees will also give their reports, including the Committee on Welding, of which John H. Zink is chairman.

Demonstrates Automatic Welding at World's Fair

A welding demonstration at Chicago's A Century of Progress that is attracting a great deal of public attention is the Weldomatic head supplied by the Westinghouse Electric & Manufacturing Co. for the central station exhibit in the Electrical Building. The illustration shows the equipment in operation welding a bead around an iron pipe. A set of rollers under the head are revolved by a motor and caus the pipe to revolve



This Automatic Welding Head Is Viewed by Thousands Every Day.

at the correct speed for which the welding current and potential are set. Once the equipment is started up, its operation is entirely automatic.

The booth in which the demonstration is held is provided with a protective glass that can be raised out of position so the visitor can have a clear view of the machine when the arc isn't on. The glass is lowered before the arc is struck.

A 200-ampere welding set provides current for the welding head. This set is located in the welding booth and is controlled from a floor panel set outside the booth and which forms a part of the general exhibit.

Highschool Lad Wins Prize for Essay on Welding

The members of the freshman class of the North Muskegon High School at Muskegon, Mich., recently wrote themes on "My Vocation," and the prize theme of the lot was written by Ralph Cooper on the subject of welding. In his essay, young Cooper shows a deep insight into problems of welding and the place for the process in industry that surpasses the knowledge of many "old-timers." The theme is illustrated with pictures and the lad dedicated it to his father, E. R. Cooper, of the Cooper Welding Co., who is proud of his son's achievement, particularly in view of the fact that he gave the lad no assistance whatever in his task of writing the essay.

Alex Churchward Passes Away

The welding industry lost an inventor of note and a master of electrical design when on July 11th Alexander Churchward succumbed to heart disease at his home in South Orange, N. J. Born in Ceylon, India, in 1872 of British parents, he was later taken to England, where he was educated. At the age of 18 he came to the United States and entered the employ of the General Electric Co., later becoming a consulting engineer.

He subsequently worked for Thomas A. Edison, and also devised for Henry Ford, at his request, a self-starter for automobiles, which was used by Mr. Ford until replaced by an improved device in 1925. He did electrical research work for the Shipping Board during the World War until 1918. Since 1921 he has been technical director of the Wilson Welder & Metals Co., North Bergen, N. J., and developed the line of Wilson arc welders. He has more than 200 patents in his name.

Beer Makes Business for Welders

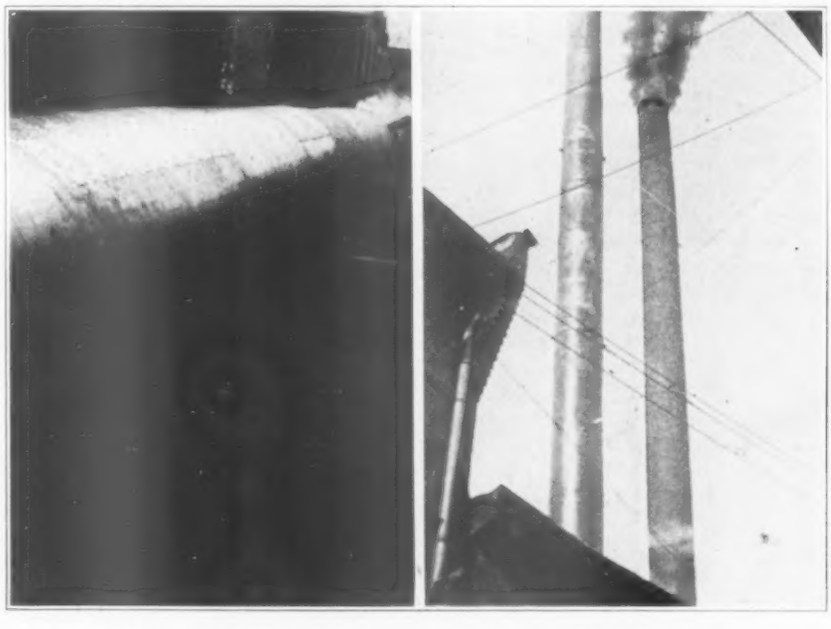
Many industrial concerns in the Milwaukee district are busily engaged in the making of welded equipment for breweries since the legalizing of beer. The Vilter Manufacturing Co. have received large orders for refrigerating equipment, involving considerable welding.

The tank and barrel business also is booming. The Heil Co. are carrying out a large production program for welded brewery tanks. It is reported that an order from one brewery alone calls for 160 tanks of various sizes and shapes. The A. O. Smith Corp. is said to be working on a production schedule of 6,000 welded steel beer barrels per 24-hour day, and the Pressed Steel Tank Co. have increased production to over 3,000 steel barrels daily to keep up with orders. The Geuder, Paeschke & Frey Co. are also manufacturing beer barrels but have given out no figures on production volume.

The builders of bottle-washing equipment are also busy, as witness the plant of the Geo. J. Meyer Manufacturing Co., in Cudahy, the shop and factory forces of which have been working at top speed to fill orders. This equipment also involves considerable welding.

Welded Smokestack 65 Ft. High

The largest all-welded smokestack in eastern Tennessee is shown in the accompanying illustrations. This stack was constructed by the S. T. Weaver Co., the pipe being rolled from 12-gage sheet iron, then welded. This work was done at a considerably smaller cost than if riveted construction had been used, states M. E. White, district manager of the Knoxville, Tenn., office of the Burdett Oxygen Co. The stack is 36 in. in diameter and 65 ft. high. One view shows the welded stack alongside a riveted stack.



Views of All-Welded Smokestack Before and After Erection.

Fighting Corrosion in Bridge Maintenance

■ By W. R. ROOF
Bridge Engineer, Chicago Great Western Railroad

Wrought-iron reinforcing plates welded to existing beams will greatly reduce corrosion caused by brine drippings, besides adding strength to the structure, laboratory tests show.

PROGRESS in the art of electric welding has greatly simplified the problem of applying additional metal to old bridge members, either to increase their strength for heavier loading or to replace metal destroyed by corrosion. The Chicago Great Western was one of the first railways to use electric welding for this purpose, and it has since been employed so extensively on various roads that rules of good practice covering the application of new metal under almost every conceivable requirement are now well established. The economy of using electric welding in strengthening steel bridges is now generally recognized.

One of the most common applications of the process is in the welding of cover plates to the top and bottom flanges of floor beams and stringers, because floor members are more frequently overstressed than any other part of an old bridge. Moreover, the drippings from refrigerator cars have a particularly corrosive effect on the top flanges of floor members, thereby necessitating the addition of new metal.

Heavier Loads and Brine Drippings Increase Maintenance

Problems of bridge maintenance that were not foreseen at the time of the older steel railroad bridges were built, have been introduced by the advent of heavy power and the increasing volume of refrigerated freight traffic hauled by the railroads. Because most of these old steel bridges were designed for lower loadings than they are now required to carry, and owing to the intensified corrosion that results from brine drippings from refrigerator cars, many of these structures are scheduled for replacement. On the other hand, there are many of these bridges that can still be repaired and strengthened to satisfy modern loading requirements.

To those responsible for the maintenance of steel bridges, corrosion due to brine drippings is a source of continual annoyance. Frequent cleaning and painting must be done to postpone the renewal of the affected parts, which oftentimes last about half as long as anticipated. On roads carrying heavy volumes of refrigerated traffic, track fastenings give half the life secured elsewhere, while damage to bridges is illustrated by the fact that a single road is now completing a program of bridge repair and renewal involving an expenditure of more than a million dollars, made necessary solely by this form of corrosion on a limited mileage of its system.

■

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Fig. 2. Typical Failure of a Test Specimen.

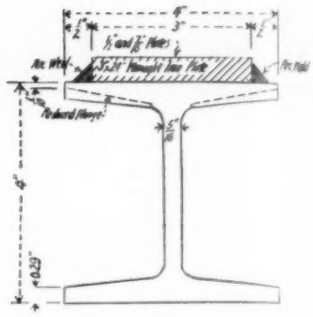


Fig. 1. Illustrating Method of Preparing Beam for Testing.

Wrought-Iron Members Show But Little Corrosion

The selection of material to be used in the reinforcement of old bridges, especially those that are subject to the action of brine drippings, is of the utmost importance. Steel is not to be recommended for this purpose because practically all the bridges that require reinforcing are of steel which is affected by brine drippings. It has been observed that members of old wrought iron bridges, which have been subjected to the action of brine drippings, have suffered little reduction in sectional area, and even after many years exposure such structures are still in good condition. Most bridge engineers will recognize this to be a fact from their own experience because nearly every railroad still has some old wrought iron bridges in service.

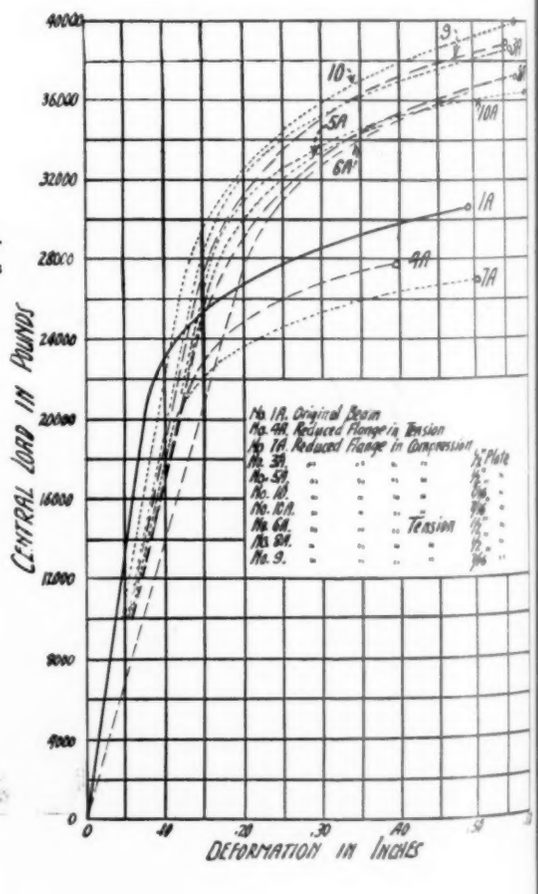


Fig. 3. Curves Showing Deformation of Test Specimens Under Load.

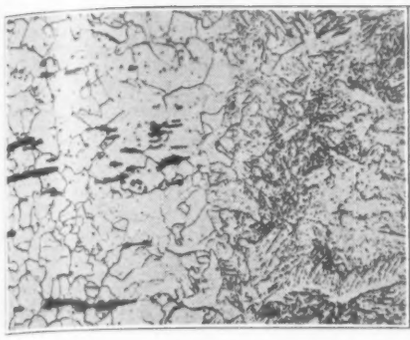


Fig. 4. Junction of Wrought Iron and Deposited Metal.

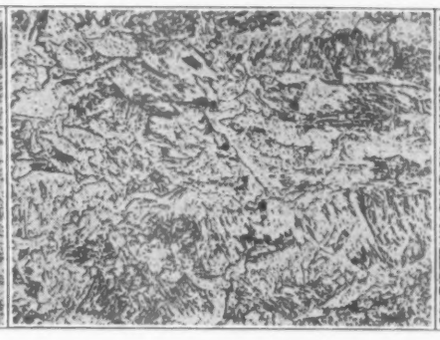


Fig. 5. Deposited Metal.

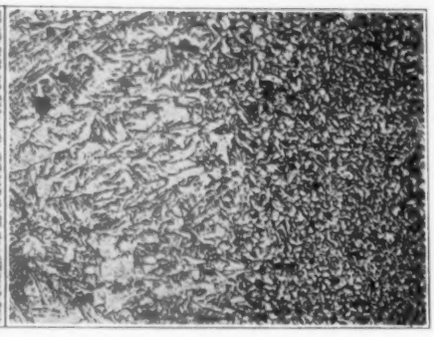


Fig. 6. Junction of Steel Beam and Deposited Metal.

Photomicrographs Magnified 60 Diameters of a Wrought-Iron Plate Welded to a Steel Beam.

In view, therefore, of the resistance of wrought iron to brine drippings, and since wrought iron plates are now available at reasonable cost, it is logical to consider seriously the use of this material for cover plates at those points on steel bridges where corrosion from salt brine is a factor. This conclusion focuses attention on two important questions, namely: (1) will wrought iron restore the necessary physical strength, and (2) can wrought iron be satisfactorily welded to steel? In order to answer these questions, a series of tests were made by a testing laboratory on steel H-beams having welded wrought iron cover plates. These plates conformed to the American Society of Testing Materials Specification A 42-30, Class A, and the writer developed the design of the test specimens.

Set-Up for Making Bending Tests

Bending tests were made of 4-in. H-beams weighing 13.8 lb. per ft. and having a length of 36 in., the beams being rested on supports 33 in. apart and subjected to a concentrated load at mid span. The tests included (a) full-size beams; (b) beams with one flange planed down to represent the reduction in area due to corrosion, and (c) reduced-flange beams reinforced by arc-welded wrought iron cover plates on the reduced flange. Part of the beams used in groups (b) and (c) were tested with the altered flange in tension and the rest with the altered flange in compression.

In Fig. 1 is shown a typical section of the tested beams, illustrating the manner in which the flanges were reduced and showing the method by which the section was restored by the use of arc-welded wrought iron cover plates. A view of one of the specimens, with a restored flange, after being subjected to the compression test, is shown in Fig. 2. The arc welds of all specimens were found to be intact after failure of the beams, even though actual ruptures of the steel beams occurred in some cases. Tabulated

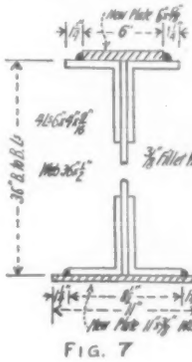


FIG. 7

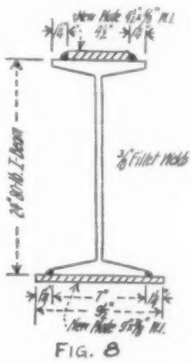


FIG. 8

FIG. 9

Application of Wrought-Iron Cover Plates to Built-Up Stringers and Floor Beams (Fig. 7), to Rolled I-Sections (Fig. 8), and Where the Top Flange Is to Be Protected Completely Against Corrosion (Fig. 9).

results of the tests are shown in the table, while Fig. 3 is a graphical representation of the results, these records indicating that arc-welded wrought iron cover plates function in a satisfactory manner.

Figures 4, 5 and 6 are photomicrographs showing the junction of the wrought iron and deposited metal, the deposited metal, and the junction of the steel beam and the deposited metal, respectively. In preparing the test specimens, the same general procedure was followed as in actual restoration and reinforcement work, except that the width of the plates was selected to permit downhand welding. Although of the same cross-sectional area, the tension plates were wider and thinner than the top or compression plates.

The method of applying wrought-iron cover plates by means of the arc-welding process to built-up stringers and floor beams is shown in Fig. 7, while Fig. 8 illustrates their application to rolled sections used for floor beams and stringers. Figure 9 shows a slight modification of the method used where it is desired to secure complete protection of the top flange from corrosion, by the application of wrought iron drip plates.

Results Show Feasibility of Using Wrought-Iron Cover Plates

An analysis of the results obtained, as shown by the photomicrographs and stress curves, satisfactorily answers both of the questions regarding the use of wrought iron that were stated at the beginning of the article, and indicates that a judicious selection and combination of materials is both feasible and practical. These test results were later confirmed on a larger scale in connection with a bridge repair program where it was found that no difficulty was experienced in welding various combinations of wrought iron and steel. In this work six welders on three bridges made a total of 18 fillet welds on wrought iron and 8

Summary of Test Results.

Test No.	Description	Weight, Pounds	Maximum Load, Pounds	Maximum Deflection, Inches	Load at Yield Point, Pounds	Relative Safe Strength	Deflection Under 1000 Lb. Load, Inches	Relative Stiffness
1-A	Original section	41.20	40,000	3¼	20,800	1.00	.045	1.000
4-A	Reduced flange in tension	38.80	37,000	3½	22,700	1.09	.062	.726
7-A	Reduced flange in compression	38.20	36,000	4	19,800	.95	.055	.818
6-A	Reinforced flange in tension with ⅜ in. cover plate	48.95	42,700	1¾	28,700	1.38	.066	.682
8-A	Reinforced flange in tension with ½ in. cover plate	49.40	43,000	2⅛	27,000	1.30	.058	.776
3-A	Reinforced flange in compression, ½ in. cover plate	50.10	48,500	3¾	23,700	1.14	.050	.900
5-A	Reinforced flange in compression, ½ in. cover plate	49.20	47,500	2¾	25,300	1.22	.051	.882
9	Reinforced flange in tension, 7/16 in. cover plate	49.50	45,800	2½	29,600	1.42	.055	.818
10	Reinforced flange in compression, 7/16 in. cover plate	49.00	49,450	3½	25,800	1.24	.043	1.045
10-A	Reinforced flange in compression, 7/16 in. cover plate	47.20	45,000	2⅝	19,400	.93	.051	.882

fillet welds on steel. The fillets were 5/16 in. and were proportioned for an assumed working stress of 2,500 lb. per linear in. For wrought iron the average weld value was 9,280 lb. per linear in. and for steel 9,520 lb. per linear in.

From the test results obtained and the well-known resistance of wrought iron to corrosion, it is evident that the application of wrought iron plates offers an economical method for the rehabilitation of existing steel railway bridges. The recognition and utilization of the inherent values of these two materials is sound engineering, as exemplified by the practice of railroad engineers who base their selection and specifications of materials on authentic service records. The known record of the behavior of any material under well defined operating conditions is a safe guide to follow.

Finds Many Uses for Metal Spraying

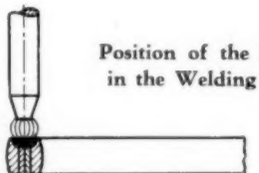
A variety of interesting metal-spraying jobs have been done by the Gerken Heating Corp., 25 Ontario St., Toledo, Ohio, of which L. A. Lebowsky is superintendent. Using a "Metallizing" unit in their shop, they recently added a 0.010-in. coating of pure tin to a cheese vat, 48x26x23 in. deep. The tin surface was brushed down with mineral wool, giving a good finish. Another job was the building up of a cold-rolled steel shaft for a large oil company; a 3/16-in. coating of 18-8 stainless steel was deposited and then the shaft was ground to its original size. This company is doing a great deal of lead coating in tanks, and is putting lettering on glass bottles, using a lead undercoat and building up with any material desired. One Toledo concern is continually sending in castings in which defects have been found after machine work has been started, to have the defects filled up with sprayed metal.

A fender manufacturer had brazed some fenders, not realizing that bronze would not take lacquer. The fenders were sent to the Gerken company and mild steel was sprayed over the bronze and then lacquered.

This company has found that angular steel grit (35 to 40 mesh) is most desirable for sandblasting prior to metal spraying. Although steel grit costs more than sand, the steel will stand 400 to 500 applications as compared to 5 applications for sand.

Welding Barrels With the Carbon Arc

In an interesting application of carbon-arc welding to the manufacture of steel barrels, the barrel is set on a turntable, the speed of which is automatically controlled in relation to the burning of the arc. This method has been applied to transport barrels of steel in which the two



Position of the Carbon Arc in the Welding of Barrels.

flanged heads and the inner and outer head rings are welded together at the same time, as shown in the diagram.

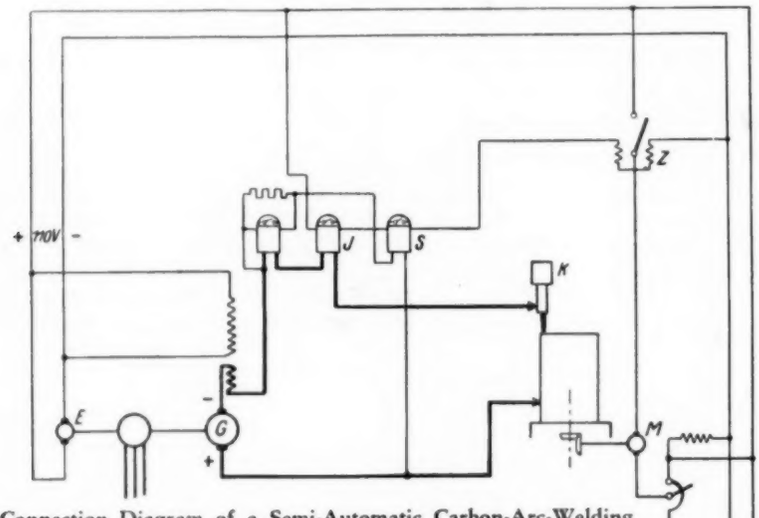
In the application of this method, the pendulum welding head is suspended from an arm that is adjustable in height. The head is guided by a roller which makes contact with the barrel shell and holds the carbon with sufficient accuracy over the edge of the barrel as it revolves.

The driving motor for the turntable must be capable of very close regulation in speed, and when the control is set for the correct speed that speed must be maintained constant during operation.

The welding head consists of a carbon holder provided with a blowing solenoid. The carbon may be advanced by a handwheel at certain intervals to compensate for the consumption of the electrode. With the barrel moving, care must be taken that the barrel is not damaged by bringing the carbon down on the barrel to strike the arc. To eliminate this likelihood, it is better to strike the arc first, and then quickly cut in the driving motor.

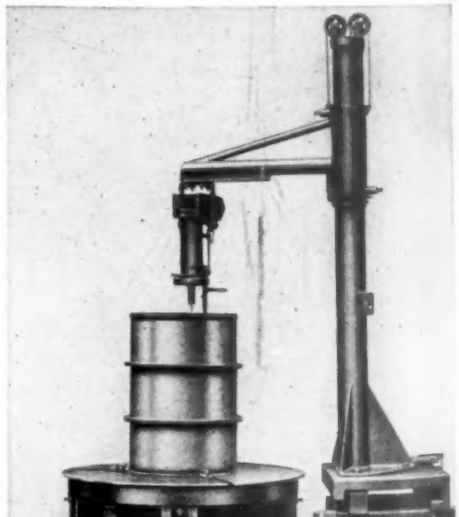
To make the equipment more automatic in its operation, the welding action can be electrically coupled with the rotation of the turntable. With this arrangement, the turntable begins automatically to rotate the moment the arc is struck, and the turntable motor is cut out when the arc breaks. Hence, whenever the arc is accidentally broken, it is not necessary to back-track the turntable, nor need the operator trouble about switching on and off the motor. The connection diagram for this arrangement is shown.

To make this equipment fully automatic, a mechanical device is added which automatically cuts out the turntable motor when it has turned through an angle of about 365°, and the carbon electrode is automatically fed by a motor-operated device whose speed depends at all times upon the welding current and the arc voltage. Then when the welding set is cut in, the operator needs only to push a button to start the equipment in operation. Thus a battery of several of these machines will require only one operator.

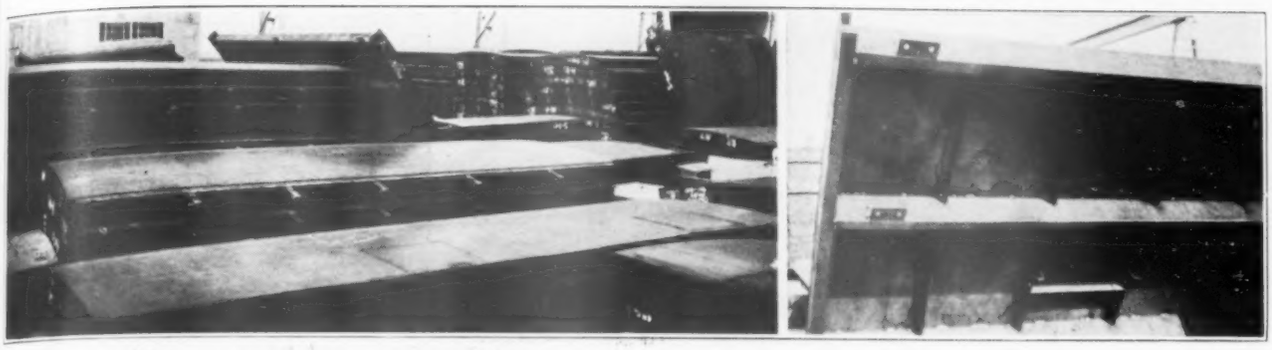


Connection Diagram of a Semi-Automatic Carbon-Arc-Welding Device for Steel Barrels.

(By the manipulation of the adjusting device K, the arc is struck, at which instant the welding-current relay J and the voltage relay S automatically close, thereby energizing relay Z and causing it to close and to start up turntable motor M. If the arc breaks, relay J opens, causing Z also to open and stop the motor. The same thing occurs if the carbon comes into contact with the work, thereby causing relay S to open. The control voltage is provided by exciter E connected to welding generator G.)



Full-Automatic Welding Device.



Figs. 1 and 2. Piles of All-Welded "Skin Plates" and a Close-Up View of One of the Plates.

Welded Skin Plates and Shutes for Boulder Dam

By W. E. ARCHER

One of the many interesting welding jobs connected with the building of the Boulder Dam project on the Colorado River is the all-welded "skin plates" for the forms used in concrete lining the four huge diversion tunnels, and the all-welded shutes and shute boxes used in conveying the concrete for the lining purpose, the fabrication of which was recently completed. As these tunnels range in diameter from 56 to 60 ft., and are about three-quarters of a mile long, a vast amount of material and welding is required in their construction.

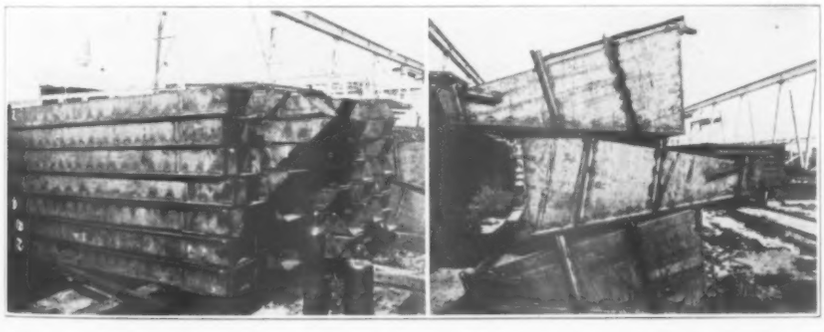
The accompanying illustrations show the work in the fabricating shop yards in Los Angeles, and give an idea of the great quantities of material required. Fig. 1 shows a corner of the yard, where some of the "skin plates" were stored before shipment to the dam site. These plate sections are made of ¼-in. boiler plate and are 20 ft. long. The widths of the plate sections vary somewhat, but average about 6 ft. The plates are welded to 6-in. channels at each end, with a middle member of like material except that a 1-in. wider channel is required for assembly purposes. Five stiffeners, composed of 4-in. angles, are also welded in crosswise at regular intervals.

Both plates and channels forming these sections are rolled before assembly to a radius of approximately 25-ft., depending upon the particular section of the tunnel in which each plate section is to be placed. This feature of the construction of these forms is well illustrated in Fig. 2. The welding on these plate sections was done entirely by the electric arc, using staggered intermittent welds about 4 in. in length and spaced 8 or 10 in. apart.

Fig. 3 shows a pile of completed shutes for conveying the concrete to the lining forms. These are made up in 17-ft. sections, using ¼-in. plate, with open tops and with 2x2-in. angles welded on each top edge as stiffeners. They are 8 in. deep and approximately 18 in. wide at one end, tapering to 3 in. narrower at the other end. Each shute is bent to shape and made of but one piece of plate, except that at the large ends a 2-ft. length is welded on as a feature for fitting the sections together and securing to the port holes, or point where the concrete enters the forms. The angle stiffeners are welded to the top edge with 2-in. welds spaced about 8 in. apart.

Some of the shute boxes, to be used as hoppers for receiving the concrete and conveying it to the shutes, are shown in Fig. 4. These are also made up of ¼-in. steel plate, cut and bent to shape and intermittent welded in much the same manner as the shutes. These boxes are 7 ft. long, 5 ft. wide, 4 ft. deep at the large end and 12 in. deep at the smaller end. The welded braces and stiffeners are formed of 2¼x2½-in. angles, with a 6-in. channel and a heavy ring welded to the bottom side for handling and securing the box in place.

All the welding was done by hand, employing "Fleetweld" rod, and was under the supervision of Hollis Leake, welding inspector for the Consolidated Steel Corp., of Los Angeles, which concern was awarded the contract for the fabrication of this equipment.



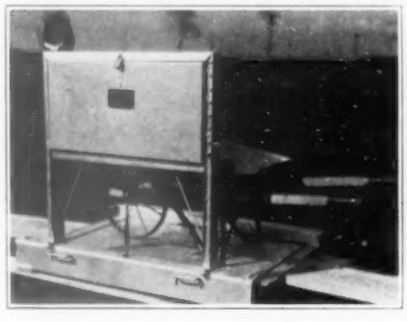
Figs. 3 and 4. Shutes (Left) and Shute Boxes (Right) of All-Welded Construction.

Presents Paper on Welding Stainless Steel

At the June 15th meeting of the Los Angeles Section of the American Welding Society, held at the Mona Lisa Cafe, on Wilshire Boulevard, an interesting feature was a paper by R. E. Brown, of the Electro-Metallurgical Sales Co., of San Francisco, Calif., on the "Practice of Welding Chromium-Nickel Steel Alloys." The meeting was preceded by the usual 6 o'clock plate dinner, and is the last meeting which will be held by this section until in October.

Collapsible Scale of Welded Construction

The C. S. Johnson Co., Champaign, Ill., are introducing a new arc-welded product known as the "Little Titan Barrow Scale." It is a collapsible scale for weighing the contents of wheelbarrows or other similar-sized loads. The wheelbarrow is run onto the platform for weighing; or the scale may be set at any desired weight, and when the load is placed on the platform an automatic signal immediately tells whether the load is too light or too heavy. When not needed, the scale may be folded up to occupy very small space, which is a great advantage in storing the scale when not in use as well as when shipping it. Two men can easily pick the scale up and carry it around.



Compact, All-Welded Scale.

Three Miles a Minute! Welding Plays an Important Part in the Fabrication of the Latest Type of Commercial Airplane.

New Type Sky Carriers Use Welding

■ By ROBERT JOHNSON
United Air Lines

Methods used at Boeing Airplane Company's plant in building sixty high-speed transport planes for cross-continent service.

ELECTRIC arc welding, first introduced to the aircraft industry in 1921, is attracting new attention in this field today through the part it is playing in turning out the latest and fastest multi-motored commercial air transport planes in the world.

At the plant of the Boeing Airplane Company in Seattle, sixty such sky carriers have been streaming out to take their places on the Coast-to-Coast, Pacific Coast and other routes of United Air Lines. Both the electric arc and the acetylene torch are busy as the big order moves along. One of these new commercial planes is being exhibited in the Travel and Transport Building at the Century of Progress, Chicago.

The welding industry, because of its role in the production, has an interest in the following facts about these planes:

Embodied in them are new standards of strength, speed, comfort and operating economy. They are of the all-metal, twin-engined type, capable not only of sustained flight but of climbing, fully loaded, on either of their two 550-hp. Wasp engines. Carrying ten passengers, two pilots, a stewardess and cargo, they cruise along at 171 miles an hour, ranking them as the fastest planes of their class in the world. On the routes of the United Air Lines, they are bringing Coast-to-Coast travel time down to less than twenty hours and are flying the Pacific Coast route, almost from the Canadian to the Mexican border, in around eight hours. Similar speedy schedules are being placed in effect on other sections of United's airway network, which gives direct or connecting service to 137 cities in forty-four states.

Welded Design Contributes to High Strength

Strength is one of the outstanding characteristics of the new plane, for Boeing engineers saw to it that no sacrifice would be made of this quality in providing high performance and comfort. Welders can take a justifiable pride in their contribution to the ship's high strength factors.

Electric arc welding is restored to for such parts as the engine mounts, wing joint fittings, retractable landing-gear treadles, spar joints, and tail gear. Oxy-acetylene welding is used for the plane's stainless-steel exhaust stacks as well as for many of the smaller parts. The aluminum fuel tanks are welded by the oxy-hydrogen process. The full range of tip sizes is used, varying according to the degree of access and the size of the flame desired.

The Boeing company's welding shop is equipped to handle metal ranging all the way from 0.019 to 3 in. in thickness, although there has been no occasion to work on any part over 1 in. thick.

Engine mounts for the new transports are of chrome-molybdenum steel (Aluminum Company of America's specification X4130). Each mount requires 187 welds, and there are two mounts to a plane. One engine mount welding job can be accomplished by two men in approximately five hours. The retractable landing gear treadles likewise are of X4130 chrome-molybdenum, and are welded with ⅛-in. electrodes.

Special training is required for all welders entering the Boeing company's employ. First, they must go through a

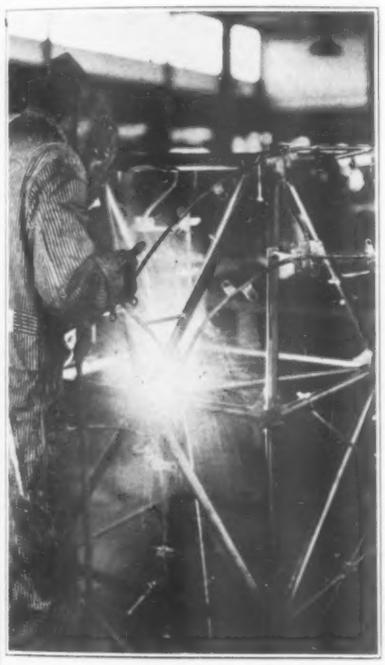
Welding Exhaust Tubing and Other Airplane Parts in the Plant of the Boeing Airplane Co.

three months' school course conducted by the firm outside working hours. To qualify, they must pass the rigid SR-14 test outlined by the Navy. Then, approximately six months must elapse before they can be employed on structural parts of a plane.

Prior to 1921, virtually all construction in the airplane factory had been of the "stick and wire" type, with wood and fabric as the chief material. Welding grew in importance when steel came into use for the internal structures of Boeing planes. With this type of construction, all assembly work was done by welding.

The use of welding diminished somewhat with the appearance of duralumin —an aluminum alloy which today is chiefly used in construction of Boeing military and commercial planes. Not as adaptable to welding as steel, this material is assembled largely by bolting and riveting.

Welding still occupies an important



Electric Arc Welder Working on the Engine Mount of One of the New Boeing Planes.

place in the aircraft manufacturing picture, nevertheless. At present, the Boeing company is employing four electric arc welders, eleven acetylene welders and three aluminum welders—and, as said before, all are experts at their jobs.

Just what these welders accomplish in imparting strength to the parts which they treat may be judged by looking over some sample reports on tests. One shows a tensile strength of 91,800 lb. per sq. in. for an X4130 steel plate with a single V butt weld; another reveals a tensile strength of 97,700 lb. per sq. in. for a tubular butt weld. These are isolated examples, but they are illuminating.

The engine mount of the transport, electric-arc welded, is designed to withstand more than 7563 lb. in weight, or almost six times the total weight of the mount and all the items it normally carries. The retractable landing gear, also electric-arc welded will stand up under a a load of 32¼ tons, although the entire plane has a gross weight of only slightly over six tons. Thus is safety assured.

Welding at the Boeing plant is not confined to the new transport planes. Military types, such as the new all-metal, low-wing, Wasp-powered pursuits and the all-metal, low-wing, Hornet-powered bomber of the Army Air Corps, as well as the single-seater, Wasp-powered fighters turned out for use on the Navy's aircraft carriers, all receive attention from the welding shop. Seven bombers of the type mentioned have been built by the company, and work is now in progress on 111 of the new-type pursuits.

Ten of the transport planes are being produced each month, with plans of completing United Air Lines' sixty-plane order by September. Not only are the carriers new in speed and strength—they also show the utmost attention to details making for passenger comfort, such as spaciousness, reclining chairs, wide windows, lavatory facilities, individual reading lamps, and cabin insulation against noise and temperature conditions.

Features of operating economy—ever important to air transport operators—include the all-metal type of construction, requiring a minimum of maintenance and repair; the interchangeability of all main divisions of one plane with those of another, easy accessibility of parts for inspection and maintenance, and low fuel consumption.

The plane has a cruising range of 485 miles, a service ceiling of 18,400 ft. and an absolute ceiling of 20,500 ft. Contrasted with its top speed of 182 miles an hour, is the amazingly low landing speed of 58 miles an hour. It takes off after a run of only 770 ft. and climbs at the rate of 830 ft. per minute, attaining an altitude of 8000 ft. in ten minutes. The wing span is 74 ft., the length 51 ft. 4 in., and the height 16 ft. (including radio mast).

CO_2 Removes Hazard When Welding Gas Tank

The article by W. E. Archer in the May issue of THE WELDING ENGINEER on how carbon-dioxide gas is being used to remove the danger when welding tanks containing inflammable vapors or gases, brings forth the story from A. V. Cassidy, of Hempstead, L. I., N. Y., of how the Hempstead Welding Co. used the gas when welding a new ring on a manhole in a tank at the state tuberculosis sanitarium near Hempstead.

The gas which the tank holds comes from the sewage-disposal plant and is piped to a burner which heats the pipes, and the hot water is then run to the sewage beds. The manhole ring had rusted away, so another had to be put on. Special precautions had to be taken because of the inflammable nature of the gas. Safety was assured in cutting and welding by turning carbon-dioxide gas into the tank until a concentration was obtained which rendered the resulting mixture non-inflammable.

To assure himself that the proper concentration of carbon dioxide was in the tank before welding was started, W. E. Christ, proprietor of the Hempstead Welding Co., disconnected the hose to the burner and put the end of it in a bucket of water. Then, through another connection, he turned carbon dioxide into the tank and kept testing the gas coming up through the water. When this gas would not catch fire any more, he started the repair by burning out the old ring, after which he electric welded the new one in. While doing the burning and welding, he kept letting a little carbon dioxide into the tank to make up for any leaks. Without carbon dioxide, the task could not have been accomplished.

Newly Built Welding Shop Damaged by "Quake"

The view shows the appearance of the new building of the National Electric Welding Corp., at 2777 Slauson Ave., in Huntington Park, Calif., after the heavy earthquake which occurred in March. All four corners of the building, which is of brick construction, were cracked open. The "quake" also gave the building a peculiar twist, damaging the roof to the extent that it has required complete rebuilding. The damage done by the same "quake" to a welding shop in Compton, Calif., was shown on page 25 of the April issue of *The Welding Engineer*.

New Structure of National Electric Welding Corp. in Huntington Park, Calif., as It Appeared After Earthquake.

Instructions for Finishing Welded Plates of Monel Metal and Pure Nickel

■ By W. F. BURCHFIELD

GRINDING, polishing and buffing monel and nickel plates can be successfully accomplished by the correct application of proper wheels and compounds, as given in this article, abstracted from the International Nickel Company's Bulletin TS-5.

MONEL METAL and pure nickel may be finished to any of the mechanically produced effects obtainable on white metal, from a sand-blast finish to the highly lustrous mirror finish.

In finishing metal, no short cuts for developing a desired effect are possible. A "base" from which all surface defects have been removed must be produced, and on this the finish is developed. The coarser the wheel required to obtain this "base," the more operations required to produce the desired finish. Each subsequent operation must remove the wheel marks produced on the metal in the immediately preceding operation. The time saving and cost saving items in finishing metal are proper selection, preparation, and care of wheels, and use of the best polishing and buffing compounds. To aid the fabricator inexperienced in polishing, the preparation of glue and the making up of new wheels are briefly discussed later.

A suitable wheel to use can best be determined by cooperation with the makers of the various types of wheels. Wheels are too important in metal finishing not to be given more consideration than the average operator gives to them. In the long run, it most certainly pays to purchase wheels from a reputable maker of buffing and polishing wheels.

Selecting Buffing and Polishing Wheels

It is impossible to make specific recommendations as to the proper wheel to use for the various operations, since the speed of the polishing machine, and the type of work to be finished, must be considered. We have made some general recommendations which should be helpful as a guide in selecting the proper type of wheel for the various operations.

The various types of wheels employed in finishing metal reach the peak of their efficiency at different speeds.

Pressure must be closely watched. Monel metal and pure nickel do not conduct heat away as rapidly as copper or aluminum, and care must be taken not to overheat the metal. Excessive heat will destroy the true color of the buffed metal and be apt to warp flat, light-gage articles.

Roughing Down the Weld

The roughing down of welds may be a particularly expensive operation if the right type of wheel is not used. Rubber bound wheels are desirable, because of their cutting effectiveness and their relative softness, thus avoiding the generation of undue heat. Excessive heat will cause buckling of light-gage sheets and has been known to cause weld cracking.

Light welds can be efficiently ground with a No. 36 grit rubber-bound wheel. For heavy welds No. 24 grit wheels are more practicable. Straight wheels, 6 in. in diameter with a 1-in. face, driven by a portable machine, are used for the general run of weld grinding.

Some operators prefer to use narrow wheels approximately the width of the weld bead to rough down the weld. These are run in the direction of the weld. This operation is followed with a finer-abrasive 1-in.-wide rubber-bound wheel, or a cup-shaped wheel operated across the weld.

Cup- or cone-shaped rubber-bound wheels are available, and are advantageous over the straight wheels for flat work, fillets, curved corners, etc.

Rubber-bound wheels should be operated at from 8000 to 9000 surface feet per minute. To obtain this surface speed, using the most common size, the 6 in. wheel requires a portable machine operating at 5000 to 6000 r.p.m.

Wheels for "roughing" and "dry fining" should be spirally machine-sewed wheels of tightly woven unbleached cotton fabric, perfectly balanced. The wheels are made up of sections approximately ¼ in. thick, these sections being rubber-cemented together to make the desired width.

Wheels that are too hard chatter; to avoid chattering they should have a soft or cushioned face, which is obtained by not gluing the sections to the very rim of the wheel. The glue should be applied only to within ½ to 3 in. of the periphery, depending upon the diameter of the wheel and the type of work being done. Fine-grit wheels require more cushion than coarse wheels. Should a wheel be too hard, it can be softened by removing the emery head and thoroughly soaking the face in warm water by rolling the wheel in the pan of water. This weakens the glue. Do not attempt to roll another head on the wheel until it is thoroughly dry.

For the "greasing" operation, a more resilient and flexible wheel is advisable, although some polishers use one type of wheel for all polishing operations. The wheel for "greasing" is also a spirally machine-sewed wheel of 64-68-count unbleached sheeting, with more cushion than is required for coarser polishing.

More attention should be given to the selection of buffing wheels than polishing wheels. Cheap wheels will not turn out a good buffing job. Buffing depends on the multiplicity of thread ends for its cutting action, which means sturdy, closely woven, high-count sheeting wheels. Close weave gives good cutting, heavy threads give good coloring.

Buffing is frequently divided into two operations,—cutting down and coloring.

Cutting-Down and Coloring

Cutting-down done with tripoli or double-duty compounds will give a sufficiently bright finish to satisfy some requirements. The coloring operation used for developing a mirror finish is best obtained with a loose-disc canton-flannel wheel; this wheel has no cutting qualities, and the surface of the metal must be fully prepared for coloring in order to bring up the mirror finish.

Since buffing-wheel sections are not glued together, they are consequently

flimsy and ineffective unless operated at a speed that will give them the needed stiffness. For this reason, "coloring" with a full-disc wheel is best accomplished at a surface speed of around 10,000 feet per minute.

Because of the high surface speeds, buffing operations create a high heat, so less pressure is used than for polishing. Consequently, the pressure must be watched very closely in buffing light-gage flat surfaces such as flat sheets, cabinet tops, etc.

Besides producing certain finishes that cannot be obtained by emery polishing wheels, brushing as a final operation produces a smooth, even finish, blending in the wheel marks of the previous polishing wheel.

The Tampico wheel, because of its flexibility, is more suitable for work with irregular contours. When used with emery cake it smooths down all previous abrasive scratches, leaving the surface ideal for buffing. Hence, it is taking the place of the old bobbing operation in the cycle of operation for developing a mirror finish.

Tampico or bobbing operations are not necessarily required in the cycle of operation for developing a mirror finish. If the grease wheel is well broken in, the tampico operation can be eliminated; but if a new grease wheel is used, the tampico wheel charged with emery paste is a required step before buffing.

Wire brushes do not remove deep scratches or blemishes from metal. Instead they perform more of a peening operation similar to a very fine sand blast, but resulting in a brighter finish than sand blasting. The surface of the metal must be prepared by polishing before brushing.

All wire brushing should be done with monel metal brushes. The reason for this is that if steel or brass wire brushes are employed, fine particles of steel or brass remain embedded in the monel metal or pure nickel, where the steel eventually rusts and the brass leaves a yellow cast to the white metal.

Preparation of Wheels

Wheels carelessly and improperly prepared are much more costly than the polisher realizes. Fabricators not thoroughly familiar with this subject should obtain booklets from abrasive manufacturers which thoroughly cover the proper handling of glue, grit, and wheels in the preparation of roll head polishing wheels.

Below are outlined a few of the most important "do's" and "don'ts" on the preparation of glue and roll head polishing wheels.

(1) Purchase only first-run hide glue from a reputable source. It is not economical to buy cheap glue.

(2) Soak the dry glue in the amount of pure, cold water recommended by the glue maker until it jells. The soaked glue is referred to as "stock."

(3) To a certain amount of stock add sufficient clean water to give the desired consistency, and heat in a covered double boiler to an even temperature of 140°-150° F. Stir the glue occasionally while heating. Burned or stale glue is useless.

(4) Various sizes of grit require different concentrations of glue solution. The Norton Company offer the following guide, subject to change due to quality of glue and the type of polishing operation.

Size of Abrasive	Per Cent Dry Glue in Solution by Weight
30	50
36	45
46	40
60-70	35
80-90	33
100-120	30
150-180	25
220-240	20

Mill Finishes of Monel and Nickel Sheets

Monel metal and pure nickel may be obtained in cold-rolled or full-finished sheets.

Cold-rolled sheets are furnished with either regular cold-rolled finish or No. 5 mirror finish. The No. 5 finish is unquestionably the best mirror finish commercially obtainable on metal. It reflects a sharp image.

Full-finished sheets are furnished in the following finishes:

(1) Regular—this is an "as rolled" sheet, which after hot rolling has been annealed, pickled, and given 4 to 6 cold passes. It does not have the heavy black oxide surface of a hot-rolled sheet.

(2) No. 8 finish is a lustrous satin finish with more reflectivity than is generally found on a satin-finished sheet. It approaches a satin finish that has been lightly buffed, though not sufficiently buffed to remove the fine scratches. This finish reflects a diffused image.

There are too many variables in polishing to permit anyone to make a set of rules which would enable the polishers, before tackling the job, to lay out a cycle of operations which if followed is certain to produce the finish desired. Polishing cycles must be worked out to fit each case.

General Rules for Polishing

Polishing information must be general, and the most that can be hoped for is that the information will guide the polisher in arriving at the most economical cycle of operations to produce the finish he desires.

Following are certain general rules that are economical aids:

(1) If a sheet is to be polished on only one side, select the side having the better surface for finishing.

(2) Determine the finest grit that will remove all the surface defects and give a "base" upon which to build the finish. To remove heavy oxide or deep defects usually requires No. 60-80 grit wheels.

(3) For wheel-polishing flat work, the subsequent polishing operation should be made with a grit 30 to 40 numbers finer than the previous one, until the metal is ready for a brushing or bobbing operation preparatory to buffing.

(4) The first operation should be a dry one. After the initial "roughing," tallow should be used on all roll head wheels of No. 150 grit or finer. Tallow clogs the wheel, giving a smoother finish, and reduces the heat generated by the friction between the wheel and the metal.

(5) Wherever possible, the scratches of the succeeding operation should cross the scratches left by the preceding operation. This is called "crossing" and definitely shows the operator when the deeper scratches of the preceding operation have been removed. More operations are usually required in producing a bright buffed finish if it is impossible to cross polish. When polishing must be done in one direction, the efficiency of the polishing wheels is greatly reduced because the finer abrasive will follow in the grooves made by the coarser abrasive.

(6) Roll head wheels properly prepared and operated at the correct speeds are necessary for low polishing costs.

(7) Use only the best buffing compounds. The initial cost may seem high, but the amount of work these produce per pound and the quality make them the more economical.

Blending a Welded Area Into the Finished Sheet

Cabinet and ornamental work is frequently fabricated from mill-finished sheets, and in fabricating it is necessary to make a weld in a conspicuous section of the equipment. In order to make the equipment appear seamless, the welded area must be blended into the finish of the parent meal. To blend in a No. 8 finish we suggest the following procedure:

Grind off the weld bead with a No. 36 or finer rubber-bound wheel, or file down the weld. (If the weld is light, this operation may be eliminated.)

Follow with a No. 80 dry emery wheel, then with a No. 120 dry emery wheel, and with a dry wheel of No. 180 fineness.

Complete the polishing operation with a No. 180 grease wheel, running the scratches in the same direction as the scratches in the parent metal.

Buff lightly. It is not necessary entirely to remove the scratch marks of the previous operation. This operation is to produce luster.

Blend in by hand, using No. 200 worn emery cloth dipped in oil. Rub in the

same direction as the scratches in the parent sheets.

To remove the grease from the finished sheet, rub the surface with Venetian lime (whiting) on a canton-flannel cloth.

Finishing Light-Gage Welded Equipment

The following operations are suggested for finishing light-gage welded equipment such as is used in hotels, hospitals, canneries, and in other applications where finish is important:

Grind the weld with a rubber-bound grinding wheel.

Use a No. 80 dry emery wheel first on the welded surface and then over the entire area.

Follow with a No. 120 dry wheel and then with a No. 180 dry wheel, finishing the polishing operation with a No. 180 grease wheel.

Brush with Tampico and emery cake.

If a bright finish is specified, buff with a wheel made from fine-count (88-88) heavy unbleached sheeting, using aluminum oxide buffing compound (white).

Clean with whiting.

If only a commercial finish is required, the procedure may be stopped following the No. 120 dry-wheel grinding.

A commercial grind, however, is seldom a sufficiently fine finish to meet the requirements of hospitals, hotels, or restaurants. To develop a fine scratch finish for this trade, follow the cycle as given above, eliminating the final operation (buffing). If a Tampico wheel is not available, the wheel work can be blended in by hand with No. 200 emery cloth dipped in oil.

Welded Dump Truck Made From Spare Parts

With the aid of his welding and cutting equipment, Ray Yocum, of DeKalb, Ill., recently completed the making of a dump truck standard truck and automobile parts and scrap equipment. On a Diamond T 3-ton truck chassis he installed a Buick motor and transmission. The old motor hangers were cut out and new hangers to fit the Buick motor were fabricated and installed by gas welding.

Immediately back of the Buick transmission, a Federal 5-ton transmission was also installed by welding, which will give 12 speeds ahead and 4 in reverse. A power take-off was then constructed entirely by welding, using Fordson tractor transmission gears as a basis, and this was installed on top of the Federal transmission. The dumping part of the truck was installed entirely by welding and is operated from the power take-off. A battery box was also welded, and the chassis itself was reinforced by the welding torch.

Get "*H. O. T.*" on Welding

■ Edited by
H. O. T. RIDLON
Welding Consultant, Joliet, Ill.

[This section is dedicated to Better Welding and Better Welding Shops. Suggestions and criticisms are invited.]

We Visit a Stone Quarry and Make a Friend

The other day I was wandering about a stone quarry, and there is plenty of work to be done about such places. Fell plum over a big "cat track" that was broken in two. The Super was with me and I looks up and says "How much cost these things?" "About $12.50 each" came the reply, and "give us a lot of trouble, too." There were about fifty on the big shovel so I looked the one over carefully. Told him I could grow it together and hard surface it for about the cost of a new one and that it would last longer. Interesting, if true, thought he and that if I really could do it, I was something of a miracle man. I'm not that, but I V'd out the crack carefully with my trusty CC cutting torch, lined it up carefully, and then proceeded to tack it in a number of places. Then, using good high-tensile rod, we made the weld in two passes, giving sufficient reinforcement. Two pieces of the cat had been broken and lost. Boiler plate cut to fit was welded in place. Then the landside was built up with high-carbon rod, bead on bead, and then a layer of hard surfacing applied. The welding was done by the metallic-arc process. And was that Super pleased and happy? He's my pal now 'cause it's been in service a while and is showing up for wear much better than the new ones.

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Observations on Eye Troubles

I'm not a doctor, but I can tell you a few things I know and have observed about the effect of welding rays upon the human system. The most interesting thing in my observation is that usually married welders experience some trouble with their eyes. And generally, single welders do not. The reason for this strange phenomenon I do not know, unless married men enjoy their own homes. Of course, there are some things we do know—one that we must have good protective shields and lenses, for the ultra-violet and infra-red rays are very harmful to the naked eye and we must have protective lenses that filter those rays completely so no damage can come to those precious nerves. We are told that the eyes are a combination of many tiny muscles. We know that exercise develops muscles and steadies nerves. Therefore, we are inclined to believe that if good goggles and shields with proper lenses are used, and care taken that cover glasses do not become pitted so as to cause strain, and are kept clean and whole, that welding will not damage a welder's eyes, but will be inclined to help them. A lot of trouble may be caused by dirt collecting in the pores of the lower lids. Using a small amount of yellow oxide of mercury on a soft, sterile cloth and rubbing the lids toward the nose, will help a lot to overcome eye irritation. Patent medicines and drops for the eyes usually contain opiates or dope and are exceedingly harmful. If you have a bad flash, go to a good eye specialist.

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We Listened to Three Good Papers in Solid Comfort

The last meeting of the A. W. S. in Chicago was held in the cool Joseph Urban Room at the Congress Hotel. For shame, many of the boys passed up a good bet, for it was a swell place to be on such a hot day. There were three good papers about the welding that was done at the World's Fair. Then Dr. Jean Piccard came in for lunch with us. The boys that were there sure got a great kick out of him for he sat about informally and told us about his coming flight to the stratosphere. In spite of his hair, he's a great guy. Happy landing to you, Jean, on your flight! But what I want to know is, where in hell are you going to keep your balloon after the flight? Boy, what my wife would say if I brought something like that home!

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Dr. Piccard Takes an Interest in Welding

Dr. Piccard tells me the Dow Chemical people at Midland, Mich., want us welders to know how to weld Dowmetal, from which his gondola is made. He tells me that it is the "coming metal" and that they are looking for new uses for it.

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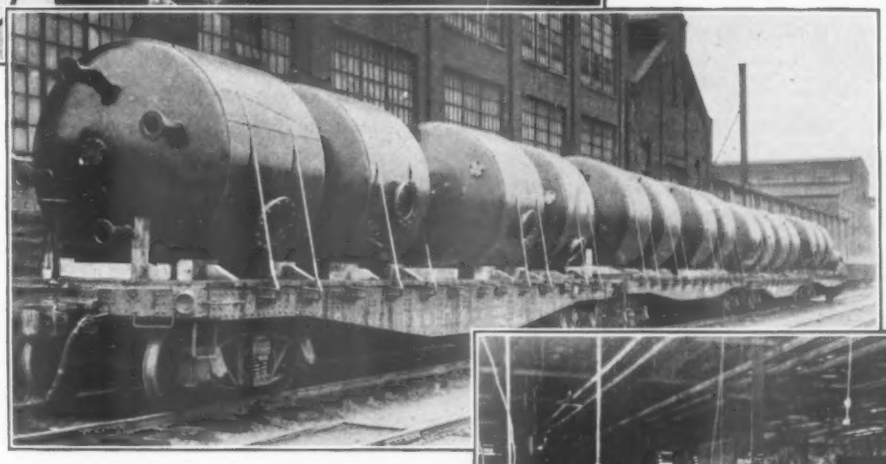
Don't Miss Seeing Those Welded Flagpoles and Handrails

You shop owners and welders will find many things to interest you and profit from at the World's Fair. In the next issue I'll chat more about those things. But there is nothing like seeing for yourself. However, the flagpoles and handrails made from angles and pipe are sure profit-getters for any welding shop. They are simple, easy to build, very strong and sturdy, and most attractive to the eye.

WELDING NEWS IN PICTURES - - -

Welding cast-steel points to steel casings or pilings for New York City's new elevated highway.

Welding reinforcing ribs on 32-ft.-diameter intake gate in Westinghouse plant at East Pittsburgh, Pa. Eight of these gates will control the flow of water from Boulder Dam.



Part of shipment of 35 arc-welded pressure tanks built by Biggs Boiler Co., Akron, Ohio, for Industrial Rayon Corp., Covington, Va. These are constructed of ⅜-in. and ½-in. plate, butt welded. (Photo by courtesy of The Lincoln Electric Co.)

Joining formed sheets by spot welding, to form sides and floors of frameless pre-fabricated house.

There's nothing dead about the casket business for those firms using rust-resisting iron with seams hermetically sealed by welding. This casket is made by the Barker Produce Equipment Co., Ottumwa, Iowa.

· E D I T O R I A L ·

This Business of Recovery

● The greatest social experiment that this nation has ever undertaken is the scheme for recovery devised by the Roosevelt administration and culminating in the National Industrial Recovery Act. In at least one very important respect this social experiment is quite different from any of the lesser ones which have been undertaken throughout this nation's brief history. ¶ The American people have very just cause to be suspicious of social experiments. Almost without exception they do not solve the problems they were devised to solve, and they result in new, unforeseen situations which plague us and result in more harm than came from the original evils themselves. An important contributing factor, however, to the general failure of social experiments is the fact that the machinery for carrying out such experiments is handled by bigoted tyrants who are blind to every rational suggestion, unless it happens to conform to their set ideas. Then when the experiment has utterly failed, those who control the machinery still rant loudly about its success, despite all evidence to the contrary, and insist on pushing their plans a little further. ¶ The National Industrial Recovery Act is a social experiment. There may be those who claim it is no different from any other social experiment that we have ever tried. Nevertheless, there is one very important difference, and that lies in the attitude of those who are controlling the machinery which this act has set up. Shortly after his inauguration, the President made a frank admission to the American people that his scheme for recovery might not be successful, but, at the same time, he made it clear that he was as willing to discard the scheme, should it fail in its purpose, as he was to adopt it in the first place. This attitude on the part of the President—and a similar pronouncement has come from General Johnson, administrator of the act—is the most significant thing that thus far has come from the President's program. This attitude should make business feel encouraged to give the President full support in the carrying out of his recovery program. It puts this social experiment on quite a different plane from those that have been tried in the past. ¶ But the workability of the program cannot be determined except by whole-hearted support from industry and from the people at large, since it is quite clear that every phase of this program is largely dependent on the other phases for its successful outcome. ¶Now, let us obtain a bird's-eye view of what this program is about. Shortly after President Roosevelt entered office, every bank in the country was closed. Multitudes of people had lost their homes, thousands of small merchants and business men had lost their businesses through bankruptcy proceedings, and the dockets of courts throughout the land were overloaded with such cases. Many millions of dollars in bonds were defaulted, including even municipal bonds and bonds underwritten by foreign governments. It led to our proclaiming an embargo on gold and declaring the gold clause in all obligations to be void. This act in itself, if not a declaration of default in fact, was bordering close to it. All these acts were the natural consequence of a rapid decline in prices following a boom period. The first prerequisite for orderly recovery was a restoration of confidence so gold would come out of hiding and a great amount of the money "in circulation" would again reach the channels of trade. Subsequent opening of banks with government sanction after the moratorium was the beginning of the revival of confidence, which was further aided by firm measures to reduce governmental costs. ¶ Unless, however, something could be done to bridge the gap between creditor and debtor which had been widened by the declining prices, it is probable that foreclosures would have continued unabated and confidence again would have been shaken. It was but natural, therefore, that legislation should follow with this aim in view and that the government should devise a method which would cause an increase in commodity prices and simultaneously an increase in wages. A program involving ultimately a decrease in the gold content of the dollar was all that was needed. The proposal was one of inflation, but it was based on a firm belief that it would start the wheels of industry going again, and that after sufficient momentum had been given to trade, the dollar could be stabilized and the inflation would not reach out of bonds. This latter part of the President's program we have not yet reached. ¶ The raising of prices, however—which has as its primary aim the easing of the present situation to the extent that debtors can meet their obligations, and the restoration of values of bonds, mortgages and other commercial paper to nearer their former levels—would be difficult, if not impossible, of accomplishment if price-cutters in various industries continued to take advantage of 7c per hour wages and if fly-by-night businesses built on a shoestring with bankrupt stocks or bankrupt machinery obtained for next-to-nothing, continued to undersell those long-established firms whose businesses were founded on goodwill between employee and employer and who are the backbone and sinew of our industrial life. This evil it was felt had to be corrected, and the broad powers given the President in the National Industrial Recovery Act is the means taken to correct it. ¶ Thus far the President's recovery program has shown clever planning and a clear understanding of social and industrial trends and conditions. If the plan succeeds, whoever it was that devised it will not only deserve the gratitude of the American people for the courage and far-sightedness shown in making such a radical proposal, but also because he will have taught the entire world a new system of workable economics, and will have shown us how we can control mass psychology and fear and thereby bring ourselves out of such a debacle as we have experienced in the past few years.

New Equipment

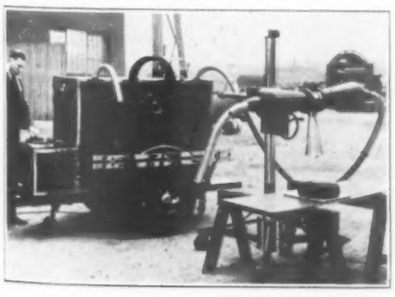
New Goggle Head Band and Adjusting Device

A newly invented goggle head band and adjustment arrangement for the elastic band when it stretches has been placed on the market. With the band are furnished what are known as adjusting pins, made of metal. The new band is said to be easily adjustable with gloves on or when the fingers are numb with cold. When the elastic band is worn out, the same adjusting pins can be used on new bands over and over again, or they can be used on any make of goggle and on any width of band up to 1 in. They allow for any amount of take-up from 1/16 in. to 3 in. or more. The adjusting pins positively will not slip after being placed in position, and they can be adjusted in a few seconds from either end of the elastic band.

This development is known as Koch's Goggle Head Band and Adjusting Pins, and is the invention of N. E. Koch, a welder of 2843 Whittier Blvd., Los Angeles, Calif.

Portable X-Ray for Industrial Purposes

The Industrial X-Ray Corporation, a $250,000 Los Angeles concern, has acquired the manufacturing and distributing rights to all the industrial "Metalix" X-ray apparatus developed by the N. U. Philips Corp., of Eindhoven, Holland, one of the world's largest industrial corporations. This equipment is available



X-Ray Equipment in Plant of Southwest Welding & Mfg. Co., Alhambra, Calif.

in three sizes, rated at 200,000, 100,000 and 55,000 volts.

The "Metalix 200" which is the largest of the three sizes constructed at the present time, can be provided mounted on a two-wheel trailer, permitting its transportation to any location. Inside the work shop or on board ship, a crane or hoist can convey the apparatus from place to place. This large type, like the smaller sizes, can be connected directly to a 220-volt a.c. outlet or to a 440-volt power main. The apparatus itself consists of three components: the high-voltage generator, constructed in a metal container; the control box, built against this container and incorporating the necessary switches and regulating and measuring controls; and two shock-proof high-voltage cables which connect the transformer to the ray-proof and shock-proof "Metalix" tube.

With 180,000 volts and 4 milliamperes, this equipment can be used to examine iron up to 3½ in. thick, and up to 4 in. with special apparatus; copper, bronze and brass up to 2½ in. thick, and aluminum up to 10 in.

The "Metalix 100" equipment is fully portable and will penetrate 1⅛ in. of iron. It consists of three hand-portable units—the tube, transformer, and control.

The "Metalix 55" is portable in a suitcase and will penetrate iron up to 5/32 in. in thickness. This type is preferably to be used for examining non-metallic substances.

One of the most important features of the Philips "Metalix" apparatus is the claim that only the primary, useful rays of X-ray emission leave the tube and biologically harmful rays are absorbed at the source. All three sizes of equipment are said to be positively shock-proof and ray-proof. Simplicity of design has been established without the sacrifice of essentials, and the unit is said to comply with all international safety regulation. The sturdy construction assures a long life, combined with low cost of operation even under the most severe service.

The main office of the Industrial X-Ray Corp. is in Room 661, Chamber of Commerce Bldg., Los Angeles, Calif. A branch office has been opened in Room 801, Blum Bldg., 624 S. Michigan Ave., Chicago, Ill.

New Line of Welding Equipment

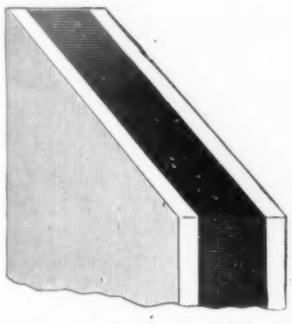
An entirely new line of welding equipment is being manufactured and sold by the Gasweld Equipment Co., 625 Jackson Blvd., Chicago, Ill., including welding and cutting torches.

The No. 200 Gasco welding torch is a general-purpose torch with brazed joints, designed to operate on equal pressures of oxygen and acetylene. It will not backfire and burn at the mixer. All sizes of tips from 1 to 14 can be used. The torch comes in two sizes, 17 and 19 in., and weighs 20 ounces. A cutting-head attachment is also available. In addition to this general-purpose torch, the Gasweld company is also making an airplane welding torch for general light production work.

The No. 70 heavy-duty cutting torch, made by this same company, is designed to permit use of 1- or 2-piece tips. The mixer for the preheating gases is in the torch head, thus preventing heat from traveling back to the torch handle. This torch weighs 36 ounces, and is said to make remarkably clean cuts and to produce a minimum of slag.

Boker Extends Line of Nickel-Clad Sheets

H. Boker & Co., Inc., 103 Duane St., New York, N. Y., are now prepared to offer to the trade their nickel-clad steel sheets in thin gages, also cold-rolled with a bright and polished finish. The hot-rolled, annealed and pickeled sheets are



Both Surfaces of the Steel Plate May Be Nickel Clad.

available from 16 gage up to heavy plate sizes, and the cold-rolled can be provided as thin as 32 gage.

These clad sheets are made by hot welding at a high-temperature approaching incipient fusion, under high pressures, a slab of pure nickel onto a steel base. The nickel surface can be supplied on one or both sides. The rolled nickel surface is non-corrosive to many commercial acids and offers a perfect base for chromium plating. A free bulletin gives information regarding welding procedures, joint design, and soldering.

This company also announces that pure-nickel-clad wire can be supplied with various percentages of cladding.

New Murex Electrode for Welding Cromansil Steel

Two additions to the Murex line of heavy-mineral-coated arc-welding electrodes are announced by the Metal & Thermit Corp., 120 Broadway, New York, N. Y. In addition to the following information, further particulars on these two products may be had by writing this company.

One of these electrodes is especially designed for welding Cromansil steel—a new development in high-strength steels, having a tensile strength of 80,000 to 100,000 lb. per. sq. in. and high ductility. The new electrode is said to give a deposit of the same analysis as Cromansil, and the weld metal has physical properties which are equal to the parent metal in every respect.

The second addition to the Murex line is an electrode which deposits a metal containing 4% to 6% chromium and 0.5% molybdenum. It is specially suited to the welding of petroleum refinery equipment, where metal of this type is used extensively.

Machine for Cutting and Processing Welding Wire

The Somaca wire-cutting machine was designed primarily for cutting in various lengths welding wire of various gages and diameters. The machine is the result of collaboration between the Sommer & Maca Machinery Corp., of Chicago, and C. H. Hollup, a specialist for many years in welding-wire development. Several different machines were designed, built and tried out before this perfected machine was offered to the welding-wire trade.

Although the machine was primarily intended for the welding-wire trade, it is just as efficient wherever wire of various lengths from 1½ in. up to several feet long is desired. While the production on welding wire is approximately 300 pieces, standard lengths, per minute, a production as high as 3,600 pieces per minute may be obtained on short lengths for other purposes.

The design is such that as the wire is being cut into lengths on this machine, it is at the same time receiving the coating (being processed), which heretofore has been a separate operation. The machine is entirely self-contained, and is operated by three individual motors, transmitting power to the drive shaft with V-belts.

The Sommer & Maca Machinery Corp. are working in conjunction with the Electric Arc Cutting & Welding Co. whereby an arrangement may be made for the user of the machine to operate under a Holslag license for the process of the wire as mentioned above.

New Patents Issued

Compiled by Patent & Technical Information Service,
1336 New York Ave., N. W., Washington, D. C.

Electric Welding Machine. 1,906,323. Max Edwin Lobley, New York, N. Y. Assignor to American Circular Loom Co., Inc., Dover, Del.

Electric-Arc Control. 1,906,496. Wilmer E. Stine and Emmet A. Smith, Cleveland, Ohio. Assignors to The Lincoln Electric Company, Cleveland, Ohio. Device for establishing an arc between the work and a suitable electrode of non-magnetic material, maintaining about said arc a magnetic field in addition to that produced by the flow of welding current in the arc and electrode, said magnetic field arranged to laterally enclose the arc and thread the pool of molten metal in angular relation to the flow of welding current therein, and rapidly reversing the relative direction of welding-current flow in the pool and the direction of flux in said field threading said pool.

Metallic Welding Electrode. 1,907,051. Wallace V. Emery, West Milwaukee, Wis. Adapted for welding a linear scarf, this electrode comprises a metal rod bearing lateral deformations of an amplitude slightly less than the width of said scarf.

Method of Welding Circumferential Seams and Apparatus Therefor. 1,907,702. James L. Anderson, Tenafly, N. J. Assignor to Air Reduction Co., Inc., New York, N. Y. A method of welding together, in a continuous tube, a plurality of tube sections, by butting the aligned sections against each other, tack welding the adjacent edges of said sections, applying a high-temperature flame to the metal along the margins of said edges, and applying rotative power directly to one only of said sections to produce first a speed of relatively high proportions and thereafter a speed of relatively low proportions.

Electrode Holder. 1,908,007. Daniel Bende, Haddon Heights, N. J.

Welding Electrode. 1,908,089. Joseph A. Weiger, Indianapolis, Ind. Assignor to P. R. Mallory & Co., Inc., Indianapolis, Ind. A welding electrode formed from a hard, tough alloy having an electrical conductivity in the neighborhood of about 80% of that of copper and containing not more than 1.25% by weight of cadmium with the remainder consisting chiefly of copper.

Flux-Coated Welding Rod. 1,909,217. Robert Notvest, Indianapolis, Ind. Assignor to J. D. Adams Manufacturing Co., Indianapolis, Ind. An arc-welding electrode provided with a coating comprising a mixture of slag-forming ingredients and an adhesive, titanium dioxide being present in quantities sufficient to counteract the effect of calcium fluoride in rendering the arc unstable.

Flux-Coated Welding Rod. 1,909,218. Robert Notvest, Indianapolis, Ind. Assignor to J. D. Adams Manufacturing Company, Indianapolis, Ind. An arc-welding electrode having a coating composed principally of a mixture of powdered mica and an adhesive.

Tool for Flash-Welding Machines. 1,909,402. Warren F. Heineman, Shorewood, and Sven Malke, Milwaukee, Wis. Assignors to A. O. Smith Corp., Milwaukee, Wis.

Arc-Welding Electrode. 1,909,679. Roy Algernon Holland, Elsternwick, Victoria, Australia. Assignor to E. M. F. Electric Co. Proprietary Ltd., North Carlton, Victoria, Australia. The process consists in coating a metallic core with an adhesive, applying fibrous material to the adhesive coating, inducing an electric charge in the fibrous particles to cause said particles to repel each other and ensure even spacing of said particles, and coating the core and fibrous material with a flux.

Method for the Manufacture of Rib-Piping. 1,909,704. Leif Morseth, Hasle Ostre Aker near Oslo, Norway. Assignor to Aktieselskapet Per Kure, Norsk Motor & Dynamofabrik, Oslo, Norway. Process for making ribbed piping by winding a ribbon helically upon a pipe, electrically heating that part of the ribbon immediately adjacent to the pipe while it is being wound upon the same, and maintaining said ribbon under sufficient tension to decrease the thickness of that portion of the ribbon remote from the pipe.

Welding Gantry. 1,910,259. Gwynne Raymond, Kansas City, Mo. A welding apparatus comprising a work support, a gantry movable over the work support, a welding head carried by the gantry, means for moving the gantry at high speed to bring the welding head into welding position, means for moving the gantry at welding speeds, means carried by the gantry for raising and lowering the welding head relative to the work support, and means for independently moving the welding head in the same direction as the movement of the gantry.

Welding Tool. 1,910,668. Lawrence H. Bevard, St. Louis, Mo. Assignor to General Steel Castings Corp., Granite City, Ill.

Welding Generator. 1,910,825. Alexander Churchward, South Orange, N. J. Assignor to Wilson Welder & Metals Co., Inc., Hoboken, N. J.

Resistance-Welding Electrode. 1,910,882. James V. Caputo, Girard, Ohio.

Electrode Holder. 1,910,973. Ernest E. Tisza, Englewood, and Louis Schmidt, Union City, N. J. Assignors to Wilson Welder & Metals Co., Inc., North Bergen, N. J.

Trade Literature

Steel fittings for light-wall piping and for Taylor spiral pipe are described and prices given in a new bulletin published by the Taylor Forge & Pipe Works, P.O. Box 485, Chicago, Ill. These fittings are fabricated from 10-gage steel plate by welding and can be furnished plain-end or flanged.

Manganese welding and hard-surfacing rods are described in a folder issued by the American Manganese Steel Co., 389 East 14th St., Chicago Heights, Ill. Directions are given for applying these rods, and photographs show various applications. Important advantages are cited for the nickel-manganese rod.

"Willson Respiratory Devices" is the subject of a pamphlet issued by Willson Products, Inc., Reading, Pa., descriptive of respirators for protection against dust, fumes and smoke, also an air-line respirator, and the new Willson sandblast helmet.

The use of nickel and nickel alloys in beer manufacturing and dispensing equipment is featured in the leading article in a recent issue of *"Inco,"* published by The International Nickel Co., Inc., 67 Wall St., New York, N. Y. Another article in the same issue relates to welded equipment in a Baltimore dairy.

Glyptal-cloth insulated cable is the subject of bulletin GEA-1746, issued by the General Electric Co., Schenectady, N. Y. It is claimed that this cable can be immersed in oil for years without deterioration, and stands a very high ambient temperature.

Description of equipment for the inspection of welding wire and of welds by magnetic means is given in catalog No. 2 of The Ferrous Magnetic Corp., 110 Washington St., New York, N. Y. This equipment includes a new type of portable magnetic inspection device for welds. Results are interpreted by means of oscillograms, which, together with corresponding photo-micrographs and radiographs, are reproduced in this catalog.

"Oxwelding for General Maintenance" is the title of a pamphlet recently issued by The Linde Air Products Co., 30 East 42nd St., New York, N. Y. This publication describes the use of the oxyacetylene process of welding and cutting in reclamation, alteration, fabrication and installation of equipment. A very useful chart gives thirteen simple tests for identifying the more common metals.

The fabrication of wheels by cutting and welding is discussed in the new "Elements of Design" Application Sheet No. 34, Series 2, issued by The Lincoln Electric Co., Dept. 234, Cleveland, Ohio. Diagrams illustrate the several methods of fabrication described.

An automatic timing device for resistance welders which is said to result in the making of sound welds irrespective of variations in voltage or condition of electrodes or material, is described in a folder issued by The Electric Controller & Mfg. Co., Cleveland, Ohio. Samples of work are shown. Magnetic switches especially designed for use with resistance welders are also described.

Commercial News

E. P. Barnes Joins Meco Staff

E. P. Barnes has become associated with the Modern Engineering Co., 3411 Pine Blvd., St. Louis, Mo., having resigned his position as supervisor of welding with the Maloney Electric Co. Mr. Barnes is concentrating his attention on sales and service in connection with Hobart welders, Meco cutting and welding equipment, and supplies for both arc and gas welding. Mr. Barnes is president of the St. Louis Welding Society and has had 21 years' experience in welding. He recently spent some time at the Hobart Bros. factory at Troy, Ohio.

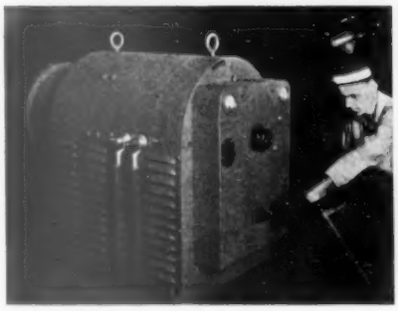
Welding Wire Made of Page-Allegheny Alloys

Arrangements have been concluded whereby the American Chain Co. and associated companies will take over the drawing, fabricating and sale of Allegheny metal and other Allegheny alloys in round, flat, and shaped wire form. This new wire will be marketed under the name of Page-Allegheny Alloys, and will be sold by the Page Steel & Wire Co., of Monessen, Pa. In addition to wire in coils, the Page Steel & Wire Co. will fabricate welding wire and other products from Page-Allegheny Alloys.

Sales of Westinghouse Welders on Upgrade

A decided increase of activity in tank and boiler construction throughout the country has resulted in an increasing number of orders and inquiries for welding equipment received recently by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

An order for a carload of welding machines was received from the Kewanee Boiler Works at Chicago, Ill. It includes twelve 400-ampere welders, the largest type of modern welding machine made for single-operator work. The order results from the Kewanee company's



One of Arc Welders Built for Kewanee Boiler Works.

recent decision to extend its welding operations in heavy tank and boiler construction. One of these machines is shown in the illustration.

The Treadwell Construction Co. of Midland, Pa., has ordered four 400-ampere welders for tank and boiler construction, and Wm. B. Scaife and Sons, Oakmont, Pa., have placed an order for three 300-ampere sets for the manufacture of tanks.

One 1500-ampere, multiple-operation welder has been contracted for by the International Harvester Co., of Chicago, Ill. Also, a three-operator 750-ampere welder was ordered by the Wicks Boiler Co., of Saginaw, Mich.

New Welding Supply House Formed in New York City

The Aceon Welding Supply Co., 3242 Broadway, New York, N. Y., is a new organization which is associated with Aceon Medical Gases, Inc., of the same address. The new company has the complete facilities of the original organization at its command and is equipped to supply commercial gases to the welding industry.

Charles H. Goodman, who is well known in the compressed-gas field in the

New York territory, is sales and service manager of the new company. W. Creagh Heydecker, with many years of experience with oxygen apparatus and equipment in the medical field, is industrial and shop manager.

"Business is on the up," says Mr. Goodman, "but it has much further to go. The user of equipment today shares this view and is in a more hopeful frame of mind."

Torchweld Opens Office in New York City

A branch office has been opened at 75-77 W. Grand St., New York City, by the Torchweld Equipment Co., of Chicago, with R. B. Spinney as district sales manager in charge. Mr. Spinney was connected with Topping Bros. in the sale of Torchweld apparatus for many years. A complete stock of equipment and repair parts is being carried at the new office.

The Esley Machinery Co., Milwaukee, Wis., have been appointed as jobbers for the line of metal-spraying equipment manufactured by the Metallizing Co. of America. The appointment was made by the Electrox Co., of Peoria, Ill., who are distributors for this equipment.

A. J. Russell, formerly vice-president and general manager of the Bettendorf Oxygen-Hydrogen Co., Bettendorf, Iowa, has become manager of The Burdett Oxygen Co. (Okla.) activities in Oklahoma, with headquarters at Oklahoma City.

Compressed Industrial Gases, Inc., and its wholly owned subsidiaries, Burdett Oxygen and Hydrogen Companies, has moved its general offices to the fourteenth floor of the LaSalle-Wacker Building, at 221 N. LaSalle St., Chicago.

The Buffalo, N. Y., district sales office of the Republic Steel Corp., has been moved to 475 Abbott Road, it is announced by N. J. Clarke, vice-president in charge of sales. No changes have been made in personnel.

Thornton F. Bright announces that he has opened offices in Room 919, 228 N. La Salle St., Chicago, Ill., where he has established himself as a consulting engineer in structural steel, plate work, and fusion welding.

The C. F. Camp Co., of Tulsa, Okla., has been appointed distributor for the full line of arc-welding units and welding equipment manufactured by the Universal Power Corp., of Cleveland, Ohio.

R. B. Wilson, who has about 20 years' service in the St. Louis territory for Joseph T. Ryerson & Son, Inc., has been made manager of the company's St. Louis plant.

Peters & Marshke, Michigan City, Ind., have been appointed distributors for G-E arc welders and the complete line of G-E welding electrodes.

The Reid-Avery Co. have announced the removal of their offices to suite 1085 in the new Broad Street Station Building, Philadelphia, Pa.

News From the Field

Thieves Return Cutting Equipment

The shop of the Spiegel Boiler Repair Co., at Davenport, Iowa, was recently broken into at night and oxyacetylene equipment, along with tanks, was taken and used to make an unsuccessful attempt to cut open the safe in the office of the Newcomb Loom Co. in Davenport.

The next morning all the "borrowed" equipment, together with the tanks, was found piled up outside the door of the shop from which it had been taken.

"O, that there were more thieves to borrow our tools instead of our honest friends and customers—our replacement costs would not be nearly so high," remarked Mr. Spiegel.

The Consolidated Steel Corporation, of Los Angeles, Calif., recently completed an extensive welding contract for the Los Nietos Producing & Refining Co., in the construction of a stabilizing tower, a rectifier kettle, and a lean oil cooler, all of which equipment for the most part was automatically welded by the steel company's special shielded-electric-arc process. Class 2 welding was employed in accordance with the A. S. M. E. Unfired Pressure Vessel Code. The contract was handled through a working agreement for the Foster Wheeler Corp.

A contract for spraying lead to the thickness of 0.015 in. on the interior of a steel digester for protection against the corrosive action of hot dilute sulphuric acid, has been awarded to the Major Engineering Works, of Des Moines, Iowa, by the Bureau of Standards, Iowa State College, Ames, Iowa. For this work equipment of the Metal Spray Co., of Los Angeles, will be used, for which the Major Engineering Works is the Iowa distributor.

Many new welding and machine shops have recently opened for business at Four Corners, Texas, a boom oil town situated in the heart of the Conroe oil field, near Houston. A great amount of welding is handled in these shops, among which are the Merritt Tool Co., the T. & A. Iron Works, the Fitzgerald-Hawthorn Machine & Welding Shop, branches of the American Iron & Machine Works, the American Foundry & Machine Co., and many smaller boiler and welding shops.

The Los Angeles Metropolitan Water District, in its preliminary work of constructing the aqueduct for transporting water from the Colorado River near Boulder dam, recently awarded contracts for the construction of 180 miles of a 5, 6, and 8-in. welded water pipeline system for supplying water for the construction of the aqueduct. Welding of this line is by the oxyacetylene process. Republic Steel Co.'s welded pipe is being used.

A 125-ft. welded stack was recently erected by the Cyclops Welding & Manufacturing Co., of LaSalle, Ill., formerly the Cyclops Welding Co., for the Peru Wheel Co. of that city. The stack is 60 in. in diameter and is made of 5/16-in. plate. It was fabricated in 5-ft. sections on the ground and then each section was raised into place and the circumferential joint was made. All joints were of the butt type.

R. W. Storm, of San Diego, Calif., recently took over the work of M. Kelly in the welding department of the Standard Iron Works. Mr. Kelly recently accepted a contract for the welding in the erection of the American Brewery Co.'s plant now under construction in San Diego. Mr. Storm was formerly associated with Rohl & Connelly, contractors on the El Capitan Dam project.

Oxyacetylene welding showed a large saving in labor and in costs over riveting in a job recently completed by the Northern Illinois Cereal Co. at their plant at Lockport, Ill. This involved the manufacture of oats steamers, which formerly required the time of two men for six days, by the riveting method, but now gas welding has cut the time down to a day and a half for two men.

A rush job of welding is under way at this time in connection with the construction of a 3,000-gallon natural-gasoline plant which is being built for the Standard Gasoline Co. in the new oil field southeast of Bakersfield, Calif. The

plant, which is being constructed with the expectation of enlargement as the field is developed, is scheduled for completion by July 15th.

Two head gates for a dam have been completed by the Muskegon Boiler Works at Muskegon, Mich. The gates are for the waterworks department of the city of Petoskey, Mich., and are of all-arc-welded construction. Lincoln "Fleetweld" welding rod was used. An unusual situation is created by an 80-ft. fall of the river within the city limits of Petoskey.

Albert Machado, formerly welder for the Pacific Irrigation & Supply Co. at Encinitas, Calif., has been placed in charge of a branch welding and pipe installation service shop at Vista, Calif. This company specializes in the installation of all-welded pipe lines and irrigation systems used in the citrus fruit and avocado groves in that district.

The Water Tube Boiler & Tank Co., Inc., 7323 Woodlawn Ave., Chicago, Ill., have developed and are marketing an all-welded gage for residential oil tanks. The housing is said to be absolutely oil-tight, and the gage is made from 14-gage sheet steel with all seams gas welded. The features of the gage are its simplicity, reliability, and low cost.

The Electric Weld Co., formerly situated at 1313 South Boyle, in Los Angeles, Calif., recently moved to 1505 Santa Fe Ave. Charley Adcock, owner and manager, is well known in Los Angeles welding circles, having followed this work in that district for the past 14 years. He specializes in truck and trailer construction and repairs.

The Master Boiler Makers & Welders Organization, of Chicago, recently elected the following officers for the ensuing year: L. F. Fewer, president; Edmon Pressler, vice-president; Harry L. Madorm, treasurer; George Nelson, secretary; and Barney Cruise, sergeant-at-arms.

John F. Linder, of Culver City, Calif., who owns and operates a welding and machine shop at 8923 Washington Blvd., recently added electric welding service to his shop by purchasing a 300-ampere Lincoln welding unit. Mr. Linder does general welding of all kinds, and has been at his present location in Culver City for over eight years.

The Shockey Boiler Works, San Diego, Calif., recently completed the construction of several large all-welded steel fish cookers for a fish-canning concern in Hawaii. These cookers are made of ¼-in. boiler plate and weigh about four tons each. Practically all welding was by the Lincoln Electric Co.'s "Fleetweld" process.

A literal translation of the term "Service Station" seems to be the keynote of A. E. Seyler, who operates the Monticello Tire Shop at Monticello, Ill. In addition to his tire service, he has a gasoline filling station, handles batteries and now he has a Hobart gasoline-driven arc welder. He is in a position now to either fill 'em up or fixe 'em up.

The South Bend Welding & Boiler Repair Shop has been opened at 1731 S. Franklin St., South Bend, Ind., by Chas. Wanner, who for eight years was with the Bock Welding & Boiler Works in the same city. A new G-E motor-driven 200-ampere arc-welding unit and Airco welding equipment have been installed.

The Southwest Welding & Manufacturing Co., Alhambra, Calif., recently completed the fabrication of four all-welded steel tanks for the Proctor & Gamble Soap Co. The tanks are 30 ft. in diameter and approximately 42 ft. high, and were erected at the soap company's plant in Long Beach.

James Durbin, formerly in charge of welding for the Beckwith Elevator Co., Los Angeles, Calif., recently opened a general blacksmith and welding shop at 2670 Randolph Ave., in Huntington Park. General welding of all kinds will be handled, with automotive welding and body work featured.

The American Machinery & Welding Works, of which Peter A. Briggs is manager, will shortly move into a new home at W1017 Broadway, Seattle, Wash. This is an 80x120-ft. one-story structure, with a steel frame roof, and was built from the brick taken after the razing of the old Avalon theater.

The Loy Welding Works on Myrtle Ave. in the Signal Hill oil field recently suffered considerable damage to its shop by the explosion of a gasoline plant two blocks away. One side wall and both front doors of the shop were blown off, and there was minor damage such as shattered windows.

About 3½ miles of pipeline welding was recently completed by the Northern Illinois Public Service Co. on a line consisting of 6-in. and 8-in. pipe extending from a distributing main to the Streator Brick Co. at Streator, Ill. Arc welding was employed throughout.

John Busgen, formerly a welder for the Marquette Cement Co., LaSalle, Ill., has opened his own shop under the name of The Illinois Welding Shop, 525 Second St., LaSalle, Ill. He has both gas-welding and portable arc-welding equipment.

The Sprague Foundry & Manufacturing Co., Council Bluffs, Iowa, doing a general furnace-manufacturing, welding and machine-shop business, destroyed in a recent $80,000 blaze, partially covered by insurance, is to be rebuilt immediately, according to Julius Katleman, owner. The firm was the largest of its kind in this section of the state.

The Andrews & Olds Boiler & Welding Co., Moline, Ill., have received a contract for building a combination stack, rain shed, and ventilator for the federal building in Rock Island, Ill. These will be entirely arc welded, and fabricated from 3/16-in. black iron. Formerly they were made of lighter-gage material and riveted.

The Northern Indiana Trailer Co. has been organized at 2132 S. Main St., Elkhart, Ind., by August Bock, Oscar Wiesenburg, and Frank Jordon. The first job made and sold by the new company is a trailer 90 in. wide, 6 ft. 8 in. high, and 20 ft. long, which has an all-arc-welded frame.

Albert A. Lehne, proprietor of the Tri-City Welding Works, Moline, Ill., has received a contract from the Standard Products Co., also of Moline, for welding a new type of cultivator shovel, which is said to remove all weeds, leave corn roots undamaged, and leave the ground smooth and level.

The General American Tank Car Corp. will in the future be known as the General American Transportation Co. The change in name was voted at a stockholders' meeting on April 11th, since it was felt that the new name describes better the company's diversified activities.

Tools and welding equipment valued at several hundred dollars recently were stolen from the plant of the E. J. Voggenthaler Co., 376 E. Eighth St., Dubuque, Iowa. Thieves took their time and picked out the most valuable and easily transported equipment.

John Jachimowiez, who operates a job welding shop and garage in Morris, Ill., is sailing on June 1st for a three-months' trip to Europe. He will be accompanied by his wife and niece and expects to visit Poland, France and Germany, as well as visit his mother in Lithuania.

Hibben & Co., of Chicago, Ill., have just completed an all-arc-welded smokestack for the International Lead Refining

Co. at East Chicago, Ind. The stack is 70 ft. high and 32 ft. in diameter. The bottom ring was of ¼-in. stock and the remainder of 3/16-in. plate.

S. C. Dawson, 1603 Florence Ave., Galesburg, Ill., who operates a portable feed-grinder among the farming community, has added a Torchweld welding unit to this equipment so he can repair farm machinery at the same time he is grinding the farmer's grain.

The Commercial Welding Works, of Signal Hill, Calif., recently purchased a complete Airco welding outfit, including regulators and combination torch outfit. D. E. Judkins, owner and operator of the shop, specializes in general oil-field welding service.

The Long Beach., Calif., branch shop of the Williamson Welding Works recently moved to 1415 East 4th St. from the former location at 4th St. and Cherry Ave. J. Knowles is manager of the shop, which specializes in car-starter-teeth welding.

Thieves recently broke into the shop of the Portable Welding Co. at 444 West 59th St., Chicago, Ill., and stole two welding torches and four regulators. Replacements have been made and the shop is running as usual, says H. Forbes, proprietor.

The Acme Welding Works, of 2748 Cherry Ave., Signal Hill, Calif., recently purchased and installed a 300-lb. Rego acetylene generator. The owners also contemplate enlarging their shop facilities by erecting an additional building.

George Hug and H. Hanna, joint partners and operators of an automotive welding and repair shop at 5110 Whittier Blvd., in Belvedere Gardens, Calif., recently moved to this address from their former location at 5396 Whittier Blvd.

Victor Nicholson has been appointed manager of The Machine & Welding Shop at Michigan City, Ind., by G. O. Reed, the new owner. The shop was previously known as The Michigan City Reliable Machine Shop.

The Steel Fabricating Co., Muskegon, Mich., have received a contract for the construction of four 200-gallon cooking tanks for the canning industry, to be fabricated of stainless steel and are welded throughout.

A new job welding shop has been opened by John Dresen at 1861 Chestnut St., Ottawa, Ill., who has purchased a new Hobart 200-ampere gas-driven portable arc welder and Rego gas-welding equipment.

Visser & Boerma, of South Haven, Mich., have purchased a 200-ampere Lincoln welding generator, which has been coupled to a 6-cylinder Pontiac motor and mounted on a Ford chassis for work in the field.

Dugan Brothers, operating a welding and motor repair shop at 5127 Atlantic Blvd., recently moved to that location from number 6237. They feature general acetylene job welding and motor and body work.

The Cash Welding Co., Galesburg, Ill., are rebuilding a "40 and 8" locomotive for the American Legion of that city to be exhibited at the national convention of the Legion to be held in Chicago this fall.

The Gibb Welding Co., Des Moines, Iowa, has added an automobile mechanic to their force to disassemble parts of cars where necessary previous to welding and to reassemble the work after completion.

French & Hecht, Davenport, Iowa, are employing welding in the manufacture of a rubber-tired wheel which they recently developed for milk wagons and other horse-drawn delivery vehicles.

A. R. Gustafson, proprietor of the Moline Welding Shop, Moline, Ill., has received a contract to install an 8-in. steam line in the new plant of the International Harvester Co. in East Moline.

Waukesha Motors, Waukesha, Wis., recently installed a metal-spray unit purchased from the Metallizing Corporation of America through their distributors, The Electrox Co., of Peoria.

The Burlington High School, Burlington, Iowa, is planning a course in metallurgy to begin this fall, which will be offered to welding operators and welding supervisors only.

Frank Rudow is moving the Rudow Welding Shop to a new location in Morris, Ill. The building he is moving into is comparatively new and he will be the sole occupant.

The Welkinson Wheel & Welding Co. has opened for business at 115 N. Monroe St., Streator, Ill., and will do general job welding and automobile-wheel straightening.

The structural-steel operating department of Joseph T. Ryerson & Son, Inc., at Chicago, recently purchased a new 400-ampere Wilson welder of the latest type.

H. C. Williams & Son, of Ottumwa, Iowa, are installing their Hobart arc welding machine in a Chevrolet chassis and will drive it with a Chevrolet 6-cylinder engine.

The Southern California Gas Co. is planning the construction of two welded pipe lines totaling approximately 87 miles in length. The lines will be laid in Kings and Tulare counties.

The Kewanee Boiler Co., Kewanee, Ill., have purchased an Airco tensile testing machine to be used to check the quality of welding being done in their plant.

A contract for welding 5000 water heaters has been awarded the Bordereaux Welding Co., 814 Fayette St., Peoria, Ill. Gas welding will be employed.

R. B. Davis, formerly of the Elkhart Welding & Boiler Works, has organized the Freight Street Welding & Boiler Co. at 105 Freight St., Elkhart, Ind.

The Ability Welding Co., formerly located at 6758 S. Ashland Ave., Chicago, Ill., has moved to 6148 S. Ashland Ave. The Sales brothers are proprietors.

The Noble Welding Shop was recently opened at Joy, Ill. A Harris welding and cutting unit has been installed, along with a "Red Head" acetylene generator.

C. Albert Thorp, formerly welder for the O. E. Sweringen garage at Neponset, Ill., has opened his own garage and job welding shop in the same town.

Slim Carstens, who operates a job welding shop in Ottawa, Ill., has added a 300-ampere gas-driven Lincoln Stable-Arc welder to his shop equipment.

A Kwik-Way grinding machine has been added to his equipment by D. W. Cooke, proprietor of the Galesburg Welding Shop, Galesburg, Ill.

Mortenson's garage at Galesburg, Ill., have added a new Smith Life-Time welding unit to their shop equipment.

The Eagle Plating Works, Omaha, Nebr., have added a Metallizing unit purchased from the Balbach Co., of Omaha.

The Marathon Electric Manufacturing Co., Wausau, Wis., are owners of a new 200-ampere Hobart welder.

Plant and Vergn, partners, have opened a garage and welding shop at 4018 Lincoln Way East, Mishawaka, Ind.